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ABSTRACT

Included are 32 of the 73 papers presented at the 1978 conference of the National Association for Environmental Education. The papers are organized into seven sections. The first section contains a single paper on environmental ethics. The other six sections are on international environmental education, energy, systems, environmental studies, environmental education research, and environmental education programs. (BB)

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CURRENT ISSUES IN ENVIRONMENTAL EDUCATION — IV

Selected Papers from the Seventh Annual
Conference of the National Association
for Environmental Education

Edited
by
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and
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NAEE OFFICES TO MOVE

Effective May 1, 1979, the headquarters of the National Association for Environmental Education will be housed at Brinker Nature Center, Troy, Ohio. Joan Heidelberg, Associate Director of Brinker Nature Center, will assume the role of Secretary of the NAEE at that time.

Mailing address will be:

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ENVIRONMENTAL EDUCATION INFORMATION REPORTS

Environmental Education Information Reports are issued to analyze and summarize information related to the teaching and learning of environmental education. It is hoped that these reviews will provide information for personnel involved in development, ideas for teachers, and indications of trends in environmental education.

Your comments and suggestions for this series are invited.

John F. Disinger
Associate Director
Environmental Education

Sponsored by the Educational Resources Information Center of the National Institute of Education and The Ohio State University.

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FOREWORD

The Seventh Annual Conference of the National Association for Environmental Education (NAEE) was held in Chicago, Illinois on April 30 and May 1 and 2, 1978. Attendance at the Chicago conference was 362 persons from 36 states, the District of Columbia and three Canadian provinces.

The Current Issues series is designed to provide a permanent record of the best papers* presented at each NAEE conference. Current Issues IV includes 32 of the 73 papers presented at the 1978 conference. The variety of topics covered by these selected papers reflects both the breadth of the environmental education field and the diversity of interests and talents of the NAEE membership.

For the convenience of the reader, we have organized this volume into seven sections. The first section consists of a single paper by T.L. Harper and S.M. Stein, a thought-provoking look at environmental ethics. The other six sections are: International Environmental Education, Energy, Systems, Environmental Studies, Environmental Education Research, and Environmental Education Programs. Assignment of papers to these sections was done somewhat arbitrarily. Readers will note that considerable overlap exists among papers assigned to different sections. This, of course, is simply a function of (the interrelationships of) the subject matter with which our authors deal.

We express our appreciation to our reviewers for their candid appraisals of submitted manuscripts, to the authors for their patience and cooperation throughout the review process, and especially to John Disinger for shepherding us through our initial year as editors of Current Issues.

The Association expresses its appreciation to the ERIC Clearinghouse for Science, Mathematics and Environmental Education for sponsoring the publication of Current Issues IV.

*Refereed Papers: Each paper submitted to Current Issues IV was refereed by two independent reviewers. Final decisions on acceptance were made by the editors.

Craig B. Davis
Arthur Sacks
Editors
November 1978

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ETHICS

THE NEW ENVIRONMENTAL ETHIC: A CRITICAL EVALUATION

T. L. Harper and S. M. Stein¹

Introduction

This paper was written in response to the observation that many people who are concerned about the state of the natural environment seem confused regarding the appropriate criteria for decision-making. It is crucial to establish such criteria before undertaking analytical, political or educational activities in this area.

Many environmental scientists and "environmentalists" accept the imminence of an "environmental crisis." By this they mean that what the environment is (or will be) diverges significantly from what (in their opinion) it ought to be. The solution proposed is the adoption of a new "environmental" ethic which considers elements of the environment to be (intrinsically) objects of ethical concern. A typical argument is that advanced by E. Odum:

As human population growth, technology, pollution, and demands on finite resources begin to tax the earth's capacity, the theory that man and the environment are a whole must be put into practice if man is to avoid self-destruction. "Holism" in terms of planning and management requires a fundamental change in man's attitude towards his environment and most important of all, an ethical basis for the necessary legal and economic incentives.

. . . in 1933 Leopold wrote:

"When god-like Odysseus returned from the wars in Troy, he hanged, all on one rope, some dozen slave girls whom he suspected of misbehavior during his absence. This hanging involved no question of property, much less justice. The disposal of property was then, as now, a matter of expediency, not of right and wrong. Criteria of right and wrong were not lacking from Odysseus' Greece. The ethical structure of that day covered wives, but had not been extended to human chattels."

"During the three thousand years which have since elapsed, ethical criteria have been extended to many fields of conduct, with corresponding shrinkages in those judged by expediency only. This extension of ethics is actually a process of ecological evolution . . .

"The first ethic dealt with the relationship between individuals. Later accretions dealt with the relationship between individuals and society. Christianity tries to integrate the individual to society, democracy to integrate social organization to the individual. There is yet no ethic dealing with man's relationship to land and to the nonhuman animals and plants which grow upon it. Land, like Odysseus' slave-girls, is still strictly economic, entailing privileges, but not obligations. The extension of ethics to this third element in human environment is, if we read evolution correctly, an ecological possibility. It is the third step in a sequence. The first two have already been taken."

Thus Leopold eloquently stated the case of a natural evolution of ethics, and he correctly predicted that the early "conservation movement" signaled the beginning of societal acceptance of an environmental ethic . . . We can confidently expect that the decade of 1970 to 1980 will bring greater acceptance of the third ethic because it must. In fact, we could argue with considerable logic that the progress man has made in formalizing the first two ethics will come to naught unless the third and final component is accepted and put into legal and economic practice.²

¹T. L. Harper and S. M. Stein, members of the Faculty of Environmental Design, University of Calgary, Calgary, Alberta, Canada.

At least three distinct positions are being advanced.³ Each requires separate evaluation. With implicit assumptions made explicit, the three positions seem to be:

Position A: Given that

1. in the past, all persons were not considered to be objects of ethical concern (for example, slaves)
2. today all persons are considered to be objects of ethical concern
3. today elements of the environment are not considered to be objects of ethical concern

it follows that

4. we ought to consider elements of the environment as objects of ethical concern (i.e., it would be a logical extension of the notion of morality).

Position B: Given that

- 1, 2, 3 as in Position A,

it follows that

4. in the future, we will consider elements of the environment as objects of ethical concern

which implies that

5. we ought to consider elements of the environment as objects of ethical concern.

Position C: Given that

1. as a consequence of our present use of the environment, people now or in the future will suffer (perhaps die), or be unable to fulfil their own goals
2. it is wrong for people to needlessly suffer or be deprived of the right to fulfil their own goals
3. if environmental elements were considered to be objects of ethical concern, we would alter our present use of the environment

it follows that

4. we ought to consider elements of the environment as objects of ethical concern.⁴

Each of the three positions fails to provide a justification for a "new environmental ethic." Positions A and C reflect confusions with regard to the nature of ethical principles. Position B reflects confusion with regard to the distinction between normative and descriptive statements. The next two sections of the paper will examine these two confusions and relate them to positions A and B. The third section will examine position C and propose modifications to it which will provide a proper ethical basis for environmental preservation.

A. Ethical Principles and Their Application

Ethical principles are action-guiding rules with universal applicability (i.e., they apply to all instances of a particular type subject to specifiable exceptions). Moral evaluation deals with the critical evaluation of human acts according to a certain conceptual framework. That is, when we think of an action as a moral action we evaluate it by reference to a set of standards. These standards define the moral realm. Thus, for example, if we say a person's act was morally praise-worthy since it was done in order to decrease the suffering of other individuals, we have critically evaluated that act as morally

praise-worthy by appealing to the standard, i.e., the alleviation of human suffering, as a criterion for proper moral behavior. As such it defines what moral action is.

Some features of moral behavior are:

1. The possibility of moral evaluation presupposes that individuals have the ability to choose between alternate courses of action. That is, the possibility of engaging in moral behavior and consequently the possibility of moral evaluation presupposes the existence of free action. A person who decides to do an act must be able, in view of this, to freely and consciously choose to do the act in question. A person who cannot make such free choices, that is a person who is either compelled to do something or accidentally does something, will not be the object of moral criticism one way or the other. Thus, for example, if an individual falls out of a window accidentally and in the course of hitting the ground falls on someone and injures him, he cannot be morally criticized for committing an immoral act.

There is a corollary of this feature of moral behavior. Moral behavior requires that all people be able, if they so choose, to engage in actions which are unselfish. If all human actions were selfish then, of course, man would not have the choice of either doing an act selfishly or not doing it selfishly. Consequently, the possibility of unselfish action is a necessary condition for moral behavior.

2. An important feature of moral behavior and moral evaluation is the universality or impartiality of moral prescriptions. Thus, when one prescribes a moral course of action, that prescription must be made without reference to a partial consideration of an individual or individuals (unless there is a morally relevant reason to do so).
3. Very roughly we can say that there are two standards or criteria which we use to define and evaluate moral behavior, which lie at the basis of moral prescription and moral obligation. The first moral criterion is positive and may be described as utilitarian.⁵ Again, very roughly, the utilitarian criteria of moral evaluation relate to the consequences of human action. Thus, if an act is engaged in which is intended to bring about an increase in happiness (or a reduction in suffering) among human beings, then from the utilitarian perspective that act is the right act. If, as a matter of fact, an action leads to consequences which increase the happiness of individuals or reduce the suffering of individuals then the consequences of that act are good. The utilitarian looks to the ends or consequences of actions. There are great difficulties with this account of morality as a criterion.⁶ However, one must agree that such considerations, however refined or limited, should play an important role in evaluating moral behavior.

The second moral criterion is essentially negative. That is, it does not tell one what should be done, but what should not be done. It puts restrictions on what one can do from a moral point of view. This negative criterion basically deals with human rights.⁷ It prescribes that all action which leads to the violation of individual rights is morally wrong. If one is to be a moral person, one must abstain from such violations. Thus, for example, if I am to engage in moral behavior, I cannot steal, rob, or physically violate another individual. Of course these are prima facie obligations and may be overridden by special considerations. For example, if one person has physically violated another, the other has the right to take action against the first on the grounds of self-defense. But all things being equal, one should not take action which violates the rights of other individuals.

These principles take different forms, but occur in or underlie the recommendations of most ethical thinkers. Some have tried to combine them in one principle:

For any situation whatsoever we are always to act in such a way as to give everyone involved - treating each man as a person deserving of respect in his own right - as much as possible of whatever it is that the person wants that is compatible with his treating his fellow men as persons.⁸

Many of the disagreements between ethical thinkers concern, not the validity of the principles, but what to do when the two principles conflict, resulting in a moral dilemma. For example, in order to relieve one person's suffering we may have to violate another's rights.

It is important to realize that while principles are universal, objective and unchanging, their application will be quite different in different circumstances. The failure to appreciate the distinction between universal principles and their situational application often leads to ethical relativism.

It is also important to recognize that these principles can be regarded as criteria for the evaluation of moral behavior. Even if it could be shown that these principles are ultimately derived from others, at worst, they are useful as a practical test for moral behavior.

The moral principles discussed above refer to "persons", "man", or "human beings". This is not an arbitrary application, but rather relates to certain properties which are necessary in order that any being be considered as an object of ethical concern.

There are three necessary conditions that must be satisfied. For a being to be considered an object of ethical concern, it must possess the ability to:

1. have positive and negative experiences and to be conscious of them (i.e., the ability to experience pleasure and pain, to enjoy or to suffer);
2. conceive of a state of affairs different from present reality (i.e., to have preferences and values, to set goals);
3. freely choose between different courses of action.

The crucial question is "what beings have these properties?" Clearly, people are the paradigm of beings which do possess these properties. Inanimate objects are the paradigm of beings which do not possess these properties. Some have argued that animals might possess these properties to some degree.⁹ A few might argue that plants also do. A rather amusing example is the scientist (Cleve Backster) who found apparent evidence that plants have feelings. However, another scientist (Eldon Boyd) managed to get the same "reaction" from a piece of styrofoam. He concluded that the effects were produced by fields associated with the investigator rather than the object under investigation. When asked why he ruled out the possibility of styrofoam having a low grade consciousness, he replied "because that's ridiculous."¹⁰

For the balance of this discussion, we will define all beings with the requisite properties given above as "people", and all beings without them as "things". Moral principles are based on the recognition that all people are of intrinsic value and worth. With the exception of possible borderline cases, our definition is the common intuitive one. Persons are defined by these properties (having goals, intentions, making choices, avoiding suffering). Whether a creature has these properties (i.e., is a person) is not a matter of attaching or removing a label. A person is not created by attaching the label "person"; a person is not destroyed by removing the label "person". A person cannot be changed to a thing or a thing to a person by fiat or decree. The fact that many whites in the U.S. south did not treat blacks as persons does not mean that they weren't. The fact that Odysseus did not treat slaves as persons does not mean that they weren't.

The ethical principle "respect the rights of all persons equally unless there is an ethically relevant reason" applied in Odysseus' day just as it does today. As Leopold points out, Odysseus would have agreed with this principle, but he would have applied it only to his fellow Greeks. Our disagreement with Odysseus would concern not the validity of the principle, but whether or not slaves were persons.

In fact, Odysseus (and other slave owners) can be shown to have recognized properties of persons in slaves, and is thereby self-condemned. (Use of the term "misbehavior" recognizes the ability to choose between alternatives after a self-conscious evaluation of them.) What was required in Odysseus' day was not a new ethic but a proper application of the old ethic to all persons.

The question of further extension of the application of ethics depends on whether the objects of concern are persons (i.e., whether they have the specified necessary properties). Elements of the environment do not, in general, possess the properties of persons. They are therefore not the proper objects of ethical concern. To consider them to be so is not a logical extension of the notion of morality, but a contradiction of that notion.

Position A thus fails to provide a justification for a "new environmental ethic." We will now look at the basis for Position B, and consider whether empirical knowledge provides us with any such justification.

B. Normative and Descriptive Statements

Argument B takes an objective, non-human viewpoint, separate from the goals and desires of persons. The purpose of such an empirical, systematic, scientific viewpoint is to describe, to explain, to predict, to understand the properties of phenomena and their relationships. It provides no grounds for evaluating one phenomenon or state as better than any other. The problem of attaching teleological significance to biological explanations is that purpose can be defined in any set of natural phenomena. For example, the purpose of cancer cells may be to grow. "Better" relates to human values. Distinctions such as clean/dirty, diversity/uniformity, beautiful/ugly relate to human needs and goals. All systems survive in some form. One state of the system is not better than another, just different.

Many purported scientific descriptions are, in fact, normative recommendations. From a scientific viewpoint, whether a certain type of pollutant produces algae is true or false, not good or bad. It is from a moral viewpoint that it is good or bad. It is from the viewpoint of human values that it is desirable or undesirable.

Many environmentalists fail to appreciate this distinction. This results in the use of ambiguous terms like Leopold's "ecological possibility" which makes it difficult to determine whether a prediction or a normative recommendation is intended. Odum's statement that "we can confidently expect that the decade of 1970 to 1980 will bring greater acceptance because it must" could be interpreted as claiming either that acceptance is inevitable (a prediction) or that it is morally necessary (a normative recommendation). Odum's prediction of the evolution of a new ethic may be correct, but this provides no basis for his normative recommendation. When a statement is normative, we are entitled to ask "what are the reasons why we should behave in the manner recommended?" The reasons we get will be related to the same old traditional ethical principles.

Some may object that here, and in our third condition for objects of ethical concern, that we have assumed the distinction we are arguing for, i.e., some concept of free will. This is true. We have assumed that all human actions are not describable in causal terms:

One class of laws in psychology gives causal explanations which seem sufficient to account for what happens to a man, but not what he does. There is another set of laws, however, which

concerns not what happens to men, but what they do - their actions, performances, and achievements. But such laws state necessary rather than sufficient conditions' As Protagoras taught, nature knows no norms. It may well be true that a man cannot remember without part of his brain being stimulated, or that is a function, in part, of antecedent "tension". But the very meaning of "remembering" and "learning" precludes a sufficient explanation in these sorts of naturalistic terms.¹²

However, if our assumption were not true, if this distinction were false, then there would be nothing to argue about. There would be no good or bad, no better or worse. There would be only prediction. Cancer cells, air pollution, suffering, death of the species, death of all life would just happen. This is not the viewpoint of advocates of the new ethic. They clearly value certain states of affairs as opposed to others.

Position B, based on scientific or empirical knowledge, thus fails to provide a justification for a "new environmental ethic". A valid justification for valuing the environment will have to be related to the goals and desires, to the well-being, of individual persons.

C. The Proper Ethical Basis for Environmental Preservation

Position C shows some promise in that it relates to the well-being of individual persons. Statement C2 (it is wrong for people to needlessly suffer or be deprived of the right to fulfil their own goals) is ethically commendable. If our present use of the environment is harmful to people, then it is wrong and should be changed. Statement C3 proposes a means to achieve this end, i.e. to consider elements of the environment as objects of ethical concern. However, it would elevate a means to an end in that it would make people and things co-equal. In some situations, this would involve violating the rights of persons,¹³ or inflicting suffering upon them, in order to save the environment. It would involve using these persons as means for the sake of things, which directly violates the original intent (as expressed in C2).

What some environmentalists (who would advocate this) are doing is advancing their own values and preferences at the expense of other people. They are attempting to dictate the goals, objectives, and lifestyles of other people. Such an endeavor is not morality but immorality. An environmental ethic which makes the environment an end in itself is not an ethic at all!

A proper ethical basis for preserving the environment must relate to the goals and to the well-being of persons. The environment should be preserved or protected whenever it relieves or prevents the suffering of persons or whenever it preserves the rights of persons. This criterion recognizes that the preservation of the environment is a means to human happiness, and not an end in itself. If an individual's activity (for example, driving his car to work) interferes with other people's ability to achieve their own goals (for example, to live peacefully in their own homes) or causes them to suffer, then these are moral grounds for government intervention. The nature of intervention which is appropriate is an ideological question. If the individual's rights to a clean environment are held to be absolute, then the activity should be prohibited. If utilitarian criteria are applied, then the polluter should be made to bear the (externality) cost of his activity.

What is needed is a new Position 'D':

Given that

1. as a consequence of our present use of the environment, people now or in the future will suffer (perhaps die) or be unable to fulfill their own goals
2. it is wrong for people to needlessly suffer or be deprived of the right to fulfil their own goals

it follows that

3. we ought to be concerned with the impact of our present use of the environment, and modify that use so that it does not inflict suffering on, or violate the rights of, individual persons (present or future).

In other words, we are advocating a position often referred to as "stewardship": that the natural resources we are blessed with don't fully belong to us but are held in trust for present and future generations.

Conclusion

We have seen that there is no justification for a "new environmental ethic" which views the environment (or elements thereof) as having intrinsic worth apart from the needs and desires of persons. Such an ethic is not a logical extension of past ethical conceptions; it is a direct contradiction of them. Such an ethic cannot be recommended on the basis of empirical knowledge or prediction, however accurate.

What is required is a proper application of the old traditional ethical principles which take into account new knowledge and new circumstances. This is implicitly recognized by most of those who argue for a "new ethic". When they warn us of the dangers or detrimental effects of a particular intervention, they mean that it is dangerous to persons, or to things valued and appreciated by persons. Only an ethic which is properly person-centered can hope to command the necessary allegiance of all persons.

Our role as educators is not to inculcate students with our personal values, biases or prejudices. It is not to teach an ethic which is not an ethic because it fails to respect the individual person. Our responsibility as educators is twofold:

1. to explicate the basic moral principles which we all hold, and teach students how to apply them, and
2. to communicate knowledge concerning the environmental effects of all types of human intervention.

Students so educated will be equipped to make their own responsible ethical decisions of a professional, a political, or a personal nature.

REFERENCES AND FOOTNOTES

2. E. P. Odum, "Environmental Ethic and the Attitude Revolution," in W. T. Blackstone (ed.), Philosophy and Environmental Crises (Athens, Georgia: University of Georgia Press, 1974), p. 10.
3. Although the article cited seems to suggest our interpretation, and others seem to have interpreted them in a similar fashion, we are not concerned here with any debate as to what the original authors meant to say. What does concern us is that these arguments underlie much of the current thinking about man's relationship with his environment.
4. Several variants of this position are common. One relates to self-preservation, another to preservation of the species (man).
5. The criterion is derived from Bentham.
6. See B. Williams, Morality (New York: Harper and Row, 1972).
7. The criterion is derived from Kant.
8. K. Neilson, Reason and Practice (New York: Harper and Row, 1971), p. 275.

9. J. Feinberg, "The Rights of Animals and Unborn Generations", in W. T. Blackstone, op. cit., p. 43-68.
10. P. Thompkins and Christopher Byrd, The Secret Life of Plants (New York: Harper and Row, 1973), p. 40.
11. E. Odum, loc. cit. (emphasis added).
12. S. Benn and R. Peters, "The Limitations of Causal Explanations," in P. Edwards and A. Pap, A Modern Introduction to Philosophy (New York: Free Press, 1965), p. 94.
13. It should be noted that all (not just owners) have rights to common resources, such as air, water, and in some instances, land.

INTERNATIONAL ENVIRONMENTAL EDUCATION

Three of the papers in this section focus on a need to internationalize environmental education. Noel Brown traces the consideration of environmental problems at a series of international conferences beginning with the Stockholm conference in 1972 and describes the goals of two conferences planned for 1978 and 1979. He describes UNEP's role as a catalyst in international environmental education and outlines a timetable for expanding EE efforts during the next four years. B. Ray Horn describes a world-wide needs assessment sponsored by UNESCO-UNEP, outlines the results of the assessment and discusses the implications of these results. He also offers a set of "World EE Guidelines for North America." Kevin Vinchattle *et al.* suggest that the internationalization of environmental studies courses should include "some exploration of the environmental perspectives held by the people in cultures other than our own." They suggest that foreign students represent a largely untapped reservoir of expertise on this subject. They describe the format and results of an undergraduate environmental studies course that used foreign students as the sources of information on environmental perspectives held by citizens of their native countries.

The fourth paper by John Towler describes a normal day at an Urban Studies Centre in Great Britain and asks why such centres have not been developed in North America.

ENVIRONMENTAL EDUCATION FROM STOCKHOLM TO TBILISI AND BEYOND

Noel J. Brown¹

Approximately one year ago, representatives from over 70 countries met at Tbilisi in Soviet Georgia to review the implications and the possibilities of application of the Stockholm recommendations regarding environmental education, as well as to study the specific ways in which education could help solve the problems of protecting the human environment. This was perhaps the first such intergovernmental conference ever held to address the question of environmental education directly and, despite a serious lack of publicity, the conference did succeed in creating the necessary framework for broad programmes of international cooperation and formulated a set of criteria and guidelines to facilitate national, regional, and international action in this regard.

Tbilisi may have placed environmental education on the world's agenda -- but we cannot leave it there. What is needed now are mechanisms and instruments to translate the recommendations of Tbilisi into workable programmes of action. Programmes that will not only find their way into classrooms and curricula, but will also help to create environmental awareness at the highest policy levels; and that will induce decision-makers everywhere to include environmental dimensions in the consideration of their policies, programmes, and projects. Above all, what we need now, in the words of one of its recommendations, is the necessary knowledge for interpretation of the complex phenomena that shape the environment, and the skills required in devising and applying effective solutions to environmental problems.

Tbilisi would thus seem to challenge educators everywhere to design systems of learning that will provide individuals and communities with the means of interpreting the interdependence and interaction between various environmental elements in space and time, so as to deepen our awareness of our changing relationship with the biosphere. The immediacy and urgency of this challenge should be all the more apparent as we review the efforts of the world community to come to terms with the changing requirements of global viability and the need to more effectively manage the world's first truly technological civilization. This effort, perhaps unique to the decade '70's, is expressed through a series of global conferences, whereby a set of global priorities have been identified and on which a measure of consensus for cooperative action has been reached. The result is what may roughly be termed an emerging global agenda. I would like to place that agenda within the perspective of our concern with environmental education, because it is here that I believe that certain critical inter-relationships need to be more clearly articulated. It is here also that I believe that the integrated perspective so fundamental to environmental education will reveal serious gaps in our efforts -- gaps which must be bridged if the reorientation of our attitudes, values, and behavior is to become the basis of a new environmental literacy.

(1) Stockholm, 1972: Environment: The Changing Relations Between Man and The Biosphere

Perhaps, prophetically, the first in the series of international conferences which began in 1972, at Stockholm, placed environment on the global agenda and in doing so alerted the world to man's changing relationship with the biosphere, and to the need to shape our actions throughout the world with a more prudent care for their environmental consequences. It has now been six years since the Stockholm Conference, and while the world has yet to turn the environment corner, the world community seems to have started in earnest the long march toward environmental protection and planetary security. For one thing: The world community now for the first time has a working environmental system, with machinery for planning, coordination, and mobilization of human and financial resources and with unprecedented levels of cooperation among its operational sectors. Central to that system is the United Nations Environment Programme serving as both catalyst and

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environmental conscience of the world. Secondly, it can now be reported that in the six years since the Stockholm Conference, more than one half of the United Nations members have established mechanisms of one sort or another to coordinate the environmental activities of the various sectors within national societies, and environmental impact standards are becoming an increasingly familiar part of the development landscape. Moreover, I believe governments are becoming increasingly convinced that the environment cannot be nationalized and that broad programmes of cooperations are necessary for our collective survival. But perhaps the most significant achievement is the emerging consensus on the meaning of environment itself. Environment is no longer a point of confrontation between the Third World and Developed World as it was at the time of the Stockholm Conference. Nor is it any longer conceived as a problem of pollution to be settled by technological arrangements or merely another luxury of the affluent who may now indulge in gratuitous contemplation of the quality of life.

Today environment is recognized as an all-encompassing concept -- the sum total of a series of organic and complementary relationships between the natural order and the growth of population, the patterns and nature of resource and space use, and such factors as societal goals, socio-economic structures and institutions and life styles. And while it may be true that industrial and agricultural development have, through mismanagement by man of natural ecosystems, created many environmental problems, including the pollution of water, soil, and air with significant costs to human health and well-being -- it is also true that environmental problems are likewise caused by the lack of development and that poverty breeds its own environmental costs. The relentless pressures that arise where basic human needs are not met can diminish or eliminate the resource base from which man must inevitably gain his sustenance. The destruction of forests, the loss of arable land, the loss of human productivity through disease and mal-nutrition, and the increasing pressure on fragile ecosystems, all of which result from poverty, are typically problems of developing countries most acutely amplified in the poorest sectors. These are as significant environmentally as the pollution of air and soil by industry and agriculture, and over-consumption and waste by the affluent. Whether intended or not, the poor possess an environmentally damaging capability, whose consequences will not remain below the poverty line.

Environment thus remains everybody's business, posing to humanity at large the same fundamental problem, namely: whether the natural order can long sustain the human enterprise, and whether the accumulated power at our command and our irrepressible drive for progress will somehow impel us to transgress those outer limits on which the continued viability of the biosphere depends. In other words, Stockholm, by placing environment on the global agenda, was, at the same time, to warn us that the continuation of life on this planet, not to mention the quality of life, could very well be elevated or reduced to a human choice -- and herein lies the central management challenge: How to ensure that those human activities and choices which significantly affect or modify the environment are properly assessed. This will require a fundamentally new approach to societal decision-making, where long-term considerations must become a premise of all decisions and a standard operating procedure. It will require also better methods for evaluating the full consequences of decisions which affect both the physical and social environments before such decisions are made. Coupled with this is the development of better techniques for allocating real costs for activities to those who benefit from them and assigning real values to such traditionally free goods as water and air.

Environmental Education Has a Role Here

(2) Bucharest '74 and The Changing Dimensions of Human Fertility

The second in the series of conferences was population, which brought into focus the changing dimensions of human fertility. By placing the question of population on the global agenda, this conference gave governments an opportunity to review and assess the issue of human fertility in all its complexity. For one thing, it

is now clear that the population problem does not lend itself to a hardware solution — we have the hardware to effectively control population; however, whether these can be broadly applied without coercion or without assaulting values still held important by a large number of the world's people is another matter. Coercive population control is not a demographic problem or even an environmental problem, but a political problem.

In spite of these reservations and many difficulties still to be overcome, the conference may yet be of monumental significance. At Bucharest, the right of each nation to determine its own optimum population level was recognized. Equally important, however, was the acceptance by each nation of responsibility for re-solving the equation of population, resources, and environment through a development process that provides for its people an acceptable condition of life. At the same time, there was agreement that the population growth cannot continue indefinitely at its present rate, and that perhaps for the first time in our history human fertility poses serious risks for human well-being and our collective future. Fortunately, the acceleration seems to be slowing down, although the pressure is likely to be felt for some time. But even as we press the search for solution, however, we must guard against counterfeit ethics and other short-sighted and morally insensitive philosophies such as triage, which would simply be "let them die" — but what if they live? I believe Bucharest was correct in reminding us that it is neither desirable nor possible to apply a life-boat ethic to our Space-ship Earth.

Environmental Education Has a Role Here

(3) Rome '74: The Changing Man to Resource Ratios

In Rome, that same year, the world community examined the changing man to resource ratios, dramatically exemplified by the world food crisis. At issue was a convergence of misfortunes — poor harvest, unfavorable weather conditions, and the almost complete depletion of traditional reserves, coupled with the changing dietary habits of a rapidly expanding world population. At issue also was the near impossibility of any rapid build-up of new surpluses without fundamental changes in the agricultural policies and practices of most states and the upgrading of the rural sector in their economic calculations. To an extent, the conference succeeded in underscoring the fact that, despite our best technologies, agriculture still remains a "weather controlled" activity and that man has much to learn about natural climate changes, although certain human activities could very well have negative influences on the world climate systems. In this regard, it is significant to note that the matters of climate and agriculture have begun to receive priority attention in a number of very important quarters.

Recently a group of scientists warned that the world has entered a period of adverse weather expected to last at least 40 years — that will reduce crop production and cause widespread famine and starvation. That study has projected cycles of famine that could affect hundreds of millions of people, even with reserve stocks of 30 to 50 million metric tons of grain available each year.

While the UNEP's own "outer limits" study of weather and climate has yet to produce such a definitive statement, there is no reason to doubt the urgency and seriousness of such a conclusion — rendered all the more ominous by the uncertainty factor. But what concerns us equally, however, is that efforts to increase yields on a regular and sustained basis through the production and use of nitrogen fertilizer could very well pose possible dangers to the ozone shield, thereby compounding the threats already established by the increasing use of the fluorocarbons, not to mention the SST's.

Environmental Education Has a Role Here

(4) Geneva '76: Changing Status of the Unemployed Man

Here the tripartite world conference on Employment, Income, Distribution, and Social Progress and International Division of Labour was to draw attention to a comparatively new issue: namely, whether the world will be able to find work for its growing labour forces. This issue was thrown into bold relief by the world recession when the chronically labour-short Europe found itself with its 18 million unemployed. As if to underscore this fact, it was reported in Europe during the last week of April that at least 31 unions representing 40 million workers took part in a strike to broadcast rising unemployment in Europe. This strike was aimed as a warning to governments that there would be more walk-outs unless people were put back to work. At the opposite extreme are the more than 700 million marginal inhabitants of the fourth world who remain permanently locked in a vicious cycle of poverty and for whom the work to survive has become the measure of their existence. Moreover, the prospect is hardly more reassuring when we are informed on the other hand that approximately 20 percent of the world population is responsible for 75 percent of its production and that the human factor is declining.

These data are but symptoms of the fact that demographic evolution and technological progress have conjoined to exclude an increasingly large number of people from the world of work and could very well introduce unemployment as a new social condition. Had the conference been disposed to exploring the moral and philosophical implication of this trend, it might very well have concluded with Pierre Gascar, that work provides a bond between human beings and is so closely bound up with the idea of progress as to make it a significant feature of the human destiny.

The conference might also have noted that apart from the dynamics of its productive activity, work provides a community with its moral dynamics -- and keeps the collective consciousness on the alert. Moreover, in most societies, work offers the only existence to a person -- "to be is to work" -- not only because people participate in production, but because they are always trying to improve their conditions or to escape from them by one means or another. The decline of work, therefore, sooner or later will face society with the question that will be the basis for the organization and more particularly the moral order of society where work is no longer the most important element in the human condition. (from "Living With Less Work", Development Forum, May 1976).

Environmental Education Has a Role

(5) Vancouver 1976: Human Settlements and the Man-Made Environment

Human settlements after all represent those primary and secondary environments where life may be enhanced or polluted at its source. This conference brought into focus the dilemmas and challenges of the man-made environment and the limits of the human capacity to adapt to a man-made order. The conference further brought into focus the fact that it is within the ambit of human settlements that we are best able to observe and assess the effect of the collision between the man-made and the natural environment and from which we will face the challenge of the man-made future. And here one need hardly emphasize the fact that the future, if there is a future, is likely to be largely man-made and that humanity will face a new and unique challenge in coping with a man-made environment. This is a challenge that has begun to pose new tests to the human adaptive capacities.

Scientists have assured us that the human species has shown a remarkable capacity to adapt to the natural environment and has over a million years of experience behind it. Whether, however, we will be as successful in adapting to the man-made environment is at this stage problematic; we have no precedents, only symptoms.

Perhaps our most vivid expression of our adaptive dilemmas is to be found in the cities — as yet the most comprehensive statement of the man-made environment. The cities, once the highest expressions of our civilization and a celebration of the human genius, have now begun to raise very serious questions about the future of the man-made environment and about our capacity to adapt to them much less "to manage them". At issue is not simply the question of size or the ability to deliver accustomed services. There are many more subtle issues whose main dimensions are only now becoming apparent, which will increasingly demand our priority attention.

Throughout the world an urban revolution is fully under way and urban populations are growing much faster than overall demographic increases — in many instances three or four times as fast. The policy implications of these developments are, at least, statistically clear. Within a generation urban populations will increase by about two billion — 1.5 of whom will live in developing countries. Within the same period the number of cities of more than one million people will increase from fewer than one hundred, twenty-five years ago, to almost three hundred, twenty-five years from now. Sixteen of these will be megacities of more than 10 million people, and the developing countries will have ten of the sixteen.

Coupled with this is the fact that shanty towns are multiplying three times as fast as socially acceptable suburbs. These towns are without essential services or health, education or employment — towns which deprive the inhabitants of even the essentials of a basic standard of life, so much so that many can never experience the happiness of simply being alive. Moreover, with this proliferation will come perhaps an increase in squalor and misery, crime and social despair unequalled in the history of mankind. Increases in these orders of magnitude will undoubtedly have vast national and global repercussions and will require major policy decisions and massive investment programmes merely to maintain the present unacceptable level of life — let alone improve them.

Environmental Education Has a Role Here

(6) Mar Del Plata '77: Concerning The Impending Water Crisis

In 1977, two additional items were inscribed on the global agenda. These dealt with the critical world water situation and the dramatic loss of soil capital through the process known as desertification. Rather ironically, these two items received considerable support from nature itself, with a series of droughts of almost catastrophic proportions in the Sahel in Africa, Europe, and even the United States — thereby conveying to national governments a sense of urgency and immediacy and underscoring the fact that no programme of human or economic development could even hope to succeed without a readily available supply of water and land capable of sustaining some level of production.

The World Water Conference, held in Mar del Plata last March, was to bring home the reality that water is a unique and vital resource, but with a fixed total stock. Next to air, it has few rivals and no substitutes, and the human genius has so far not succeeded in inventing more water. Covering seven-tenths of the earth's surface, with a volume of 1.4 billion cubic kilometers, or 326 million cubic miles, it is distributed according to nature's own design, not ours. Had the United Nations been called upon to construct the hydrological cycle, or apportion the water stock, our efforts would have been based on the principle of equitable geographic distribution. Not so with nature: 97.2 percent of the planet's water is in the seas and oceans, two percent in the polar caps and glaciers and less than one percent representing the total amount of fresh water available for all living things outside the oceans. Yet this amount, according to the best scientific evidence, is enough to meet all foreseeable human needs. Even with a doubled world population with its four-fold increase of water requirements, the hydrological cycle would provide more than three times as much water as each person in the developed world now uses. Now, if these basic quantitative and per capita statistics were definitive, then the so-called water problems would be more than pessimistic speculations of the Dooms Day variety.

But there are problems, or most certainly there will be unless some fundamental changes occur in our planning, management and use of water, and unless greater care is exercised in our interference and manipulation of the hydrological cycle. Two of the most urgent being availability and quality. Reasonably safe supplies of drinking water are unavailable for at least one-fifth of the world's city dwellers and three-quarters of its rural people. In many countries, less than one half of the urban population and less than one-tenth of the rural population are served with an adequate and safe water supply. Put another way, some 70 percent of the world's population today is without safe dependable water and the consequences are staggering. Water-borne diseases kill more than twenty-five thousand people every day. Schistosomiasis afflicts some 200 million people in 71 nations. Filariasis, the world's biggest cause of blindness, affects 250 million. Malaria still strikes at 100 million people a year and kills one million of them. Typhoid, cholera, dysentery and hepatitis continue to take a heavy toll on human life and health. All of these diseases are helped on their disastrous way by unsafe and contaminated water.

A recent survey of eight developing countries has shown that 90 percent of all child deaths could be avoided by safe water supplies and hygienic sanitation and sewage disposal. In Sri Lanka, it is reported that 30 percent of all the inpatients and 40 percent of the out-patients are being treated for water-borne diseases. Rather significantly the problems are confined almost exclusively to the developing world. Six hundred million people in Southeast Asia lack easy access to safe water. In Africa, the figure is 140 million; in Latin America and the Caribbean, 90 million; in the eastern Mediterranean countries, 140 million and, in the Western Pacific, 60 million. And it is the rural areas that are hardest hit. The World Health Organization reports that 90 percent of the people in the rural areas of the Third World are using unsafe water all of the time and that the sewage and household wastes of 1000 million rural people remain in or near their homes and spread disease by contaminating food, soil, and water. According to the World Bank, it will take at least 60 billion dollars to supply safe water in developing countries and some 200 billion dollars more to dispose of it properly. And, as if to underscore the magnitude and disparities of this issue, the World Bank in 1977 invested some 300 million dollars in water supply and sewage disposal programmes.

Over and above these, dramatic statistics is the rapidly expanding volume of pollutants that increasingly affect water quality. As a matter of fact, it has been reported that we are polluting water at a faster rate than we are conserving it; and pollution, after all, is the most important factor that limits water supply. Now at low population densities, pollution of water bodies can be eliminated by dilution, sedimentation and self-purification by micro-organisms. This permits the repeated use of the same water without any serious hazards to health. Problems arise, however, when man-made chemicals are discharged that are not easily degraded; or when concentrations of human settlements, live-stock or industry, leads to pollution of such intensity that the assimilative capacity of the receiving water becomes insufficient and it quickly becomes degraded and in turn loses many of its potentialities for human use. The threat inherent in such pollution concentrations is often not localized, since fresh water contaminants are generally carried to the sea by rivers, and contribute accumulatively to the global problems of marine pollution in somewhat irreversible ways.

A growing source of contamination which is beginning to receive attention is that posed to atmospheric water, or what in the scientific vernacular is termed "acid rain", posing threats to both ground and surface water. Increasing contamination of the atmosphere by such pollutants as sulphur oxide and nitrogen oxide which, in turn, result in concentrations of sulphuric acid and nitric acid, has begun to affect the hydrologic cycle in the form of acid rains. This development is beginning to produce a number of adverse results which are likely to intensify, particularly if the burning of fossil fuels, especially coal, is increased as predicted. Electric power plants, smelters and steel mills that burn coal and oil are the leading sources of nitrogen oxides (Boyce Reasberger: New York Times, 23 May 1977).

Acid rain is a phenomenon which knows no boundaries, as any European state would easily attest and its impact on our water resources is beginning to assume very dangerous proportions. Among the most well-documented examples of such impacts are the following:

- (1) Acid water's impact on marine life, particularly fish; it impairs the maturation of fish larvae and impedes reproduction as well as causing large-scale fish kills.
- (2) Acid water's ability to dissolve metals in the soil (aluminum, mercury, and lead -- including that in lead pipes -- which in turn enter community water supply sources).
- (3) Acid water's poisoning of insects which in turn are eaten by birds and fish, causing a new chain of destruction.
- (4) Acid water's stunting of plant growth -- the gradual acidification of soils may cause changes in the types of vegetation growing in affected areas.
- (5) Acid water's corrosion of monuments of such celebrated statuary as the Taj Mahal and the Cultural Heritage of Greece.

Control of such contamination of the world water supply would seem to be a matter that should be given even higher priorities on the human agenda. It was issues such as these, together with the problems of waste, that moved the United Nations Water Conference to recommend measures for the better planning and management of the world's water resources and to urge governments to design appropriate frameworks within which different positions, interests, and approaches could be harmonized.

Surely, Environmental Education Has a Role Here

(7) Nairobi 1977: The United Nations Conference on Desertification

Similar strategies for cooperation were also advanced in connection with the problems of desertification and here the rationales can be seen in the magnitude of the challenge. According to scientists, between one-third and one-half of the world's land surface is arid and some 628 million people, or 14 percent of the world's population, live in vulnerable drylands. Of these, between 50 and 78 million are immediately affected by decreased productivity brought about through desertification.

During the last fifty years, for example, on the southern edge of the Sahara alone, 650,000 square kilometers (65 million hectares) of once productive land have become desert. Throughout the world, about 60,000 square kilometers (6 million hectares) are being lost annually to desertification. Areas of greater size are partly damaged. The losses wrought by the process are manifested in various ways, the most serious being the loss of degradation of human life. It has been estimated, for example, that during the drought in the Sahel, over 200,000 people died and millions were victims of severe hunger and malnutrition. Moreover, in lands which are affected in degrees by this form of environmental degradation, the gap between actual and potential production (if the lands were not desertified) amounts to nearly 16 million dollars annually. As should become clear, desertification is thus not only a major environmental hazard, but also a major obstacle to development. And it is caused mainly by man, wrestling to secure a livelihood under acutely hostile conditions. In Africa, where the problem is most severe, whole countries are located entirely in arid or semi-arid areas and will continue to suffer substantial loss of productive land to desertification. Others could have their economic base destroyed, as happened to various ancient civilizations. Sixteen of the thirty "least developed" of the developing countries are suffering from desertification.

Despite the magnitude of the problem there was, before the United Nations Conference on Desertification, no focus within the international community on desertification and no international programmes designed specifically to combat it. Various members of the United Nations family and other intergovernmental bodies and bilateral and multilateral programmes, however, have dealt and continued to deal with aspects of development of arid lands, elements of which are concerned with combating desertification. Now, however, thanks to the Conference, a global Action Plan has been formulated and all elements of the United Nations' system have been mobilized to launch a world programme to halt the march of the deserts. And action has now been started on a broad front ranging from a green belt across North Africa to the initiation of special desert patrols in California.

The global cost of corrective measures to prevent continuing net losses of land through desertification is estimated at 400 million dollars annually — exclusive of national and regional costs of infrastructure and administrative and other programme support machinery. This is the order of magnitude of the minimum amount of funds required to achieve and maintain "zero desert growth". The benefits which would accrue would be in the region of 1,300 million dollars annually, representing a benefit/cost ratio of about 3.3:1. This, however, would only be "standing still". To turn the tide of desertification through reclamation would require considerably greater expenditures and produce even greater benefits. A target of reducing the area of desertified land by six million hectares annually through reclamation would involve annual costs of 800 million dollars and benefits close to 2.6 billion dollars. A programme for recovering land lost over the last 25 years would thus cost in the region of 20 billion dollars, spread over a period of 25 years, with recovery of the damage achieved in 40 to 50 years.

In order to finance this programme, an ingenious series of measures have been advocated, ranging from loans from national governments and world capital markets and private investments to taxes on desert products, including petroleum, and assessments from armaments expenditures. This latter was among a number presented to the UN Special Session on Disarmament.

(8) New York 1978: Special Session on Disarmament

Here the issue of disarmament was examined from the perspective of its relationship to the development process. With an annual arms expenditure of over 300 billion dollars, the question arises whether a significant percentage of the resources so allocated might not be directed to accelerating the development process. This session comes at a time when the Third World has intensified its call for a new international economic order and a greater automaticity in the flow of resources between the North and South.

The session represented a long-delayed response to the clamour of the Third World that "thirty years have passed since the United Nations launched the effort to establish a new international order. Today that order has reached a critical turning point. The hopes that it offered for a better life for the whole human family have been largely frustrated. It has proven impossible to meet the 'inner limits' of satisfying fundamental human needs. On the contrary, more people are hungry, sick, shelterless and illiterate today than when the United Nations was first set up." And this at a time when the world's production capacity has never been greater. (from the Cocoyoc Déclaration, Cocoyoc, Mexico, 1976).

Despite material limits to growth, the failure of world society to provide a safe and happy life for all is not caused by any present lack of physical resources — since it is physically and technically possible to do so. The problem today is not absolute physical shortages but economic and social maldistribution and misuse, and the world arms picture provided perhaps the most dramatic example. Whether governments will be inclined to reallocate resources, as the conference is likely to advocate, is problematic. What is less problematic, however, is the fact that in a world where some 800 million people live in a state of dire deprivation, investments in equity may prove in the end to be a better guarantor of our collective security and survival, than additional investments in armaments. Security, through equity may yet prove to be a viable option.

(9) 1979: Science and Technology for Development

It would again seem far more prophetic than accidental that a decade which began with concern for the environment should close with a Conference on Science and Technology -- because herein we find the two dimensions of the man-made and natural orders in juxtaposition if not on a collision course. And herein the message of Stockholm becomes even more clear. "Man is both the creature and moulder of his environment, which gives him physical sustenance and affords him the opportunity for intellectual, moral, social, and spiritual growth, and that in the long and tortuous evolution of the human race on this planet a stage has been reached when, through the rapid acceleration of science and technology, man had acquired the power to transform his environment in countless ways and on an unprecedented scale..."

Not only have we transformed the environment, however, but we have significantly modified many elements in the biosphere vital to the maintenance of life. Moreover, in the process, we have created a world so new and so intrinsically different that we are no longer able to grasp the whole intuitively or naturally. Somehow learning has not orientated us toward an overall perspective on the many complex dimensions of our evolution, nor have we been able to discern the enduring continuity which links the actions of today with the consequences of tomorrow. This is probably because education had not been made a functional part of our productive activity, or kept pace with the dynamics of human progress.

We are, however, encouraged to believe that a start has at least been made. The Global Conference process has succeeded in identifying a set of global priorities which all humanity shares. We have also succeeded in achieving the necessary political consensus to chart desired courses of action. What is needed now is a more integrated perception of these developments which will enable us to acknowledge that the natural and man-made environments are profoundly interdependent and to act toward our life support system in a way which is truly rational.

Needed also are the commitments of resources and efforts necessary to give meaning to our new understanding of environmental education as defined at Tbilisi and reflected so clearly in the United States Environmental Education Act of 1970, namely that:

Environmental Education is an integrated process which deals with man's inter-relationship with his natural and man-made surroundings, including the relation of population growth, pollution, resources allocation and depletion, conservation, technology and urban and rural planning to the total environment.

For its part, UNEP is determined to continue its catalytic work in environmental education; we are also committed to encouraging and supporting all serious efforts to ensure that the gains made at Tbilisi are properly consolidated and the recommendations implemented. We are aware, of course, of certain major inadequacies which have impeded progress so far; these include:

- (a) Inufficient incorporation of environmental concerns in educational curricula;
- (b) too little support or stimulus for the preparation of appropriate instructional materials, including teaching guides, textbooks, and audio-visual aids;
- (c) Inadequate attention to the education and training of teachers and teacher educators;
- (d) Too few non-formal environmental education programmes for urban and rural populations;

- (a) Almost total absence of legislation related to the introduction of environmental education in the formal and non-formal education systems;
- (f) Absence of any organizational framework in most countries for environmental education, in which representatives of educational and environmental protection authorities, practicing teachers at different levels, organizations concerned with environmental education and the mass media could come together and formulate policies;
- (g) Inadequate provision for the orientation (education and training) of policy-makers, planners and professionals whose work, actions or decisions have an impact on the environment;
- (h) Scarce resources including financial provisions;
- (i) Lack of coordination of United Nations' programmes and activities at the regional and international levels;
- (j) Certain important shortcomings in the conceptual appreciation of the issues.

Overcoming these inadequacies is a key item in our strategy and planning in the area of environmental education. An essential component of that strategy is the necessity of mobilizing the entire United Nations' system through a process of thematic joint programming on environmental education. Of equal importance in this regard are the attempts by UNEP to ensure that the momentum generated at Tbilisi is not lost. To this end we have set the following timetable:

(a) By mid-1978:

- (i) To have undertaken thematic joint programming on environmental education
- (ii) To have developed a coordinated United Nations environmental education programme

(b) By the end of 1979:

- (i) Full functioning of the programme activity centre for environmental education and training (Africa)
- (ii) To have begun to coordinate implementation of the United Nations environmental education programme
- (iii) To have held a workshop on the impact of environmental education at graduate level

(c) By the end of 1980:

- (i) Promotion of a series of experiments on environmental education, teaching, training, and research
- (ii) Establishment of the programme activity center for environmental education and training (Europe)

(d) By the end of 1981:

- (i) Exchange of experience and review of progress on initial implementation of the United Nations environmental and education programme

- (ii) Comparative studies of environmental education in developing and developed countries
- (iii) Further research and development on environmental education

(e) By the end of 1982:

- (i) Advanced application of new ideas, the results of experiments and experiences
- (ii) Establishment of the global programme activity centre for environmental education and training and of an international panel of experts as an advisory body to it
- (iii) Advanced implementation of the United Nations environmental education programme
- (iv) Major evaluation of achievements, problems, trends, and issues, including evaluation of the programme activity centres

In the final analysis, however, the central issue is not whether the timetable is realistic or accurate, or even whether we achieve the goals outlined -- what is more important is the extent to which each government will be encouraged to conceive environmental quality as a personal responsibility. In this regard, the challenge to educators in helping to broaden the world's environmental education base is nothing short of revolutionary. But that is no reason to be defeated in advance, as this may yet be one of the most innovative and creative periods in adjusting our relationship to the natural order. As one wise commentator was recently to encourage us, "in our life time a new phase has opened in the story of our species, our new understanding forces us to concede that the planet was not designed with us in mind, yet we have it in our power today to make the world at least our home" (Gerard Piel).

**WORLD ENVIRONMENTAL COMMUNICATION AND EDUCATION NEEDS:
HOW THEY VARY, WHAT IT MEANS**

B. Ray Horn²

Dr. Fritz Schumacher, author of one of the most relevant books of our time, Small is Beautiful (1973), died an untimely death last September in Switzerland.

Shortly before his death, 4,000 University of Michigan students welcomed him as hero and patron saint of the world Environmental Movement. Ralph Nader reportedly carries a worn copy of Small is Beautiful in his raincoat for reading on airplanes. And at a press conference, the Governor of California waved a copy in front of reporters, declaring that "If you want to understand my philosophy, read this" (Woodward, Barnes, and Bishop, 1976, p. 50).

Dr. Schumacher's message was as simple as it is powerful. People can best meet their wants by first scaling them down to what they really need and by, second, developing socially and environmentally appropriate technologies to help satisfy those needs. Such ideas, to be sure, are having a profound influence, especially in the international arena. The U.S. Congress, for example, has authorized 20 million dollars to the U.S. Agency for International Development (USAID) to help the less-developed countries invent appropriate technologies (Woodward, Barnes, and Bishop, 1976).

Although derived independently, my central thesis and the practical guidelines I will present parallel and support Schumacher's message. The cornerstone of my paper, however, will be the hard data recently collected through a study of environmental communication, education, and information resource-needs in 136 countries. This foundation study was conducted by this author and two other principal investigators, Dr. William B. Stapp and Dr. Louis Albala-Bertrand, under the aegis of the new United Nations (UNESCO-UNEP) International Environmental Education Programme (Horn, 1975b; Stapp, Albala-Bertrand, and Horn, 1975). The overall structure and process of the new UNESCO-UNEP Program, however, have already been well described by Stapp and others in a number of recent articles, so they will not be outlined here (see Stapp, 1975, 1976a, 1976b, 1978; McGregor, 1977; and Ingram, 1977).

In this paper, I will first describe the nature and intent of the worldwide needs-assessment. Second, I will present some of its key findings. Third, I will compare the findings from North America with worldwide trends. Fourth, I will identify some themes that reflect recent thinking about world-development problems. Fifth, within the context of these themes, I will discuss what the findings of the worldwide study mean and some of their implications. Sixth, I will offer a few concrete guidelines for future environmental education (EE) program development in North America.

The UNESCO-UNEP Worldwide Study

The 136-country study gives us worldwide data about environmental communication, education, and information resource-needs and priorities. The study helps provide a sound knowledge-base to which national, regional, and worldwide EE policy decisions can be affixed. The study will be replicated every 3-5 years, giving us the needed information to help measure, evaluate, and recommend change over time. Any attempt at planning EE strategies without such a knowledge-base would be like driving blindfolded: you would have no idea where to steer.

The data were gathered principally through a 177-item questionnaire which yielded the remarkably high response rate of 83 percent, the usual response rate for this kind of study being about 20-30 percent. This rate can be accounted for, in part, by the very high interest expressed by UNESCO member states concerning EE and, in

¹The views expressed in this paper as well as the selection and interpretation of facts are the responsibility of the author and do not necessarily reflect the views of UNESCO nor UNEP.

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particular, the UNESCO-UNEP Program. Another likely influence on the high response rate was the personal visits by EE consultants to 83 countries in the less-developed world (for example, see Horn, 1975c).

Coordinated through the Ministry of Education of each UNESCO member state, multidisciplinary teams from all major social sectors and interests were instructed to meet jointly and complete the questionnaire. The teams were to comprise not only environmental experts and officials but also representatives of citizen groups and policy-makers.

The questionnaire sought quantitative and qualitative information for each of 7 major categories of resource-needs. The conceptual framework delineating and interrelating the categories is shown in Figure 1. The unmeasured or assumed influences are shown with dotted lines.

The two most basic inputs were EE legislation (measured with 8 questions) and funds for EE (measured with 10 questions). As shown in the accompanying Figure, a political willingness was assumed. The four operational factors were:

- EE organizations and associations (measured with 5 questions),
- trained EE personnel (measured with 8 questions),
- EE instructional materials and media (measured with 12 questions), and
- physical facilities for EE (measured with 5 questions).

Given the needed planning and coordination, and the proper timing, phasing and mixing of the important elements, various kinds of EE programs for different target groups, in or out of school, can be put together. Also included would be mass media programs for the general public or specialized audiences. Thus, the questionnaire assessed the need for a wide range of alternative program types (measured with 10 questions).

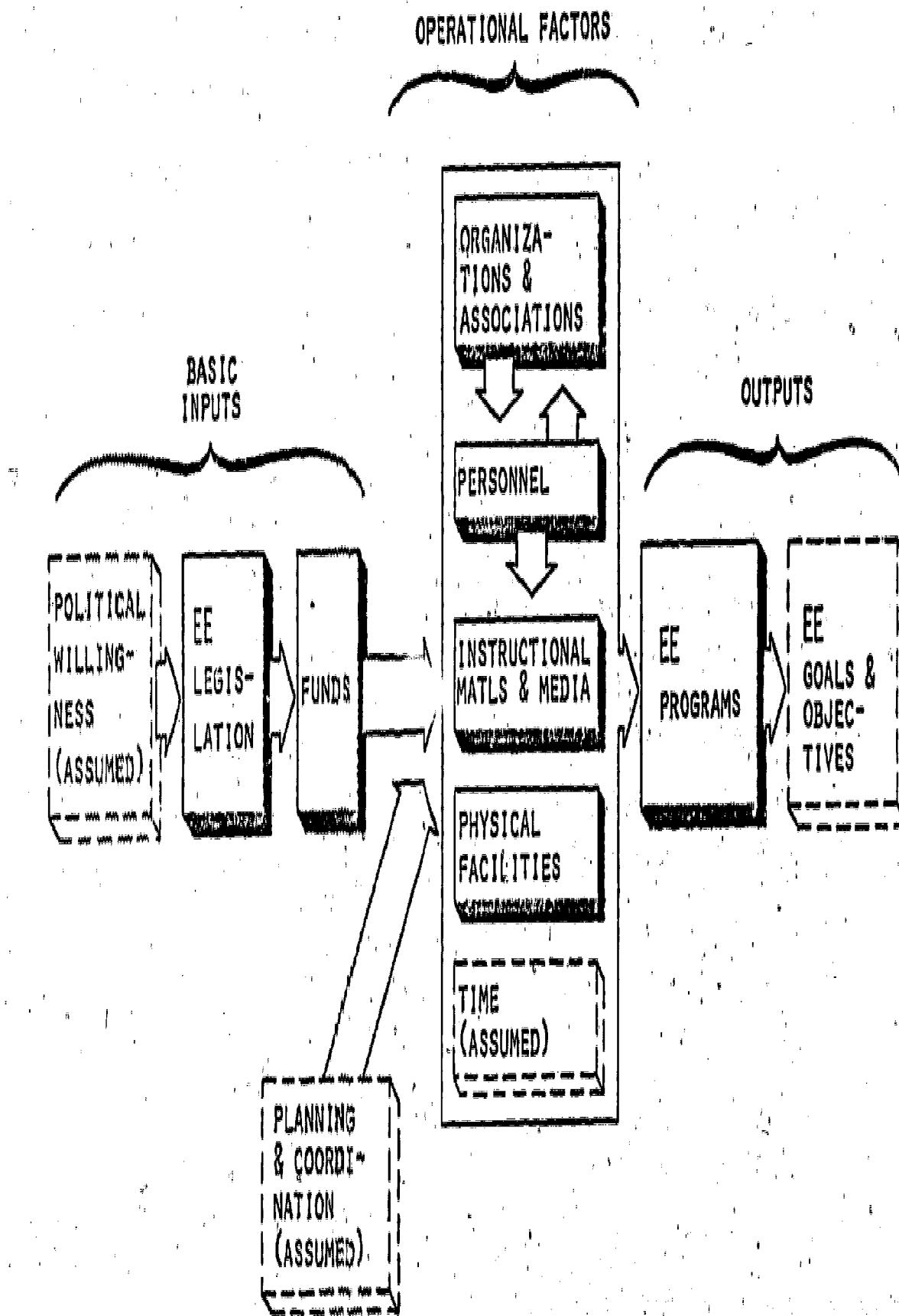
Besides the 58 questions covering the 7 categories, other items were also included. For example, there were queries about the relationships between and within each category, and there were many open-ended items as well. Our aim, though, was not to chop the world into separate pieces like chunks of ice, but rather to melt the now fragmented EE world into a single ocean, and then study its life currents, crosscurrents, and the contours of its waves. In all, we were able to capture over 24,000 coded pieces of useful information through the mailed questionnaire alone.

Beyond the questionnaire, other kinds of complementary information were also gathered. For example, a great deal of quantitative and qualitative information was gleaned from official United Nations statistical documents, special public and in-house reports, and from the EE consultant missions to 83 countries (for example, see Horn, 1975c). Thus, the extensiveness of this first worldwide study was indeed large, creating a whole sea of information through which to navigate.

Since a book-length document would be needed to relate all findings, only some of the key aspects will be described and interpreted below. Further, all comparisons will be made relative to the world average (mean) score for a particular item or cluster of items. In other words, instead of comparing one region with another, or singling out certain nations, the more neutral practice of comparing and contrasting regions against a worldwide baseline has been chosen.

On the other hand, it may be necessary to break regions down into subregions or even smaller units for operational purposes. Many aspects of some regions, for example, may be too diverse to make useful generalizations. In such cases, averaging may conceal more than it reveals. At this time, however, only findings at the regional level will be given. North America, for example, will be treated as a single regional unit.

FIGURE 1
CONCEPTUAL FRAMEWORK OF EDUCATIONAL PROCESS LEADING TO EE GOALS AND OBJECTIVES



Worldwide EE Resource Needs and How They Vary

Our major finding on the worldwide level was that 71 percent of the countries surveyed had "very high" levels of needs for EE resources. "Very high" means equal to or greater than 4.0 (on a 5-point scale). Among the very high needs, those perceived as being the most intense at the world level were:

- (1) the training of personnel for environmental education and communication activities (81 percent of the countries)
--the lack of trained EE manpower therefore being perhaps the most serious constraint,
- (2) the preparation of instructional materials and media (73 percent), and
- (3) the development of integrative environmentally-oriented programs (68 percent).

Reflecting some of the imbalances among nations, we found that almost all (84 percent) of the countries with a "high" (above 3.5) level of need for environmental education and communication programs were from the less-developed regions of Africa, Asia, Latin America, and the Arab States. But some significant pockets of program needs were also found in the more-developed regions.

Other conclusions indicate the necessity of a better integration of activities concerning the environment with other national programs, especially with those in the formal education sector. Formal education programs are often conducted in isolation from mass media programs and other very influential community activities.

A great deal of stress was also placed on the need to structure the content and orientation of EE programs around:

- (1) concrete problems (for a good programmatic example in North America, see Watkins, 1975),
- (2) the acquisition of problem-solving skills (examples of the range of such skills are given by Pinnon, 1972; Havelock and Havelock, 1973; Koberg and Bagnall, 1974; Horn, 1975a; Adams, 1976; Alshuler and others, 1977; and Souder and Zeigler, 1977), and
- (3) interdisciplinary approaches (numerous North American examples may be found in the back issues of The Journal of Environmental Education).

Sixty-eight percent of the countries responding felt the need to strengthen organizations in regard to participation in EE activities. In this regard, the less-developed countries expressed a greater need than the more-developed countries. While EE organizations are just now beginning to emerge in many countries and regions, there is perhaps an oversufficiency of such national organizations in North America--again reflecting the great asymmetries worldwide. In the future, we are likely to see not only the rapid growth of EE organizations in the less-developed regions, but also a reduction in the number of national-level North American EE organizations. At the same time, the North American organizations will strengthen as they merge in order to lessen their inefficiencies and redundancies. Moreover, we are likely to see them become more international to better reflect a Spaceship Earth philosophy.

Within the next decade, we will likely experience the emergence of an international EE association, patterned somewhat after the now existing International Communication Association (ICA). An issue-oriented, multilingual, scholarly international journal of EE will likely emerge too. Such a journal would be designed around concepts of global unity as well as diversity.

According to our world survey, some regions of our globe varied dramatically as to their needs for EE resources. Some regions of the world, for example, consistently reported needs for EE resources which were higher than the world averages. Africa, for example, was consistently higher than the world averages across all categories of EE resources. Along with Latin America, Africa had the highest levels of needs worldwide for out-of-school adults. Africa also reported needs equal to or greater than 4.0 (on a 5-point scale) for EE centers, organizations and associations, and trained EE personnel.

As one might predict, the Arab States reported a level of need for EE funds that was lower than the world average. They did, however, report a need level equal to or greater than 4.0 for both EE organizations and associations and trained EE personnel.

Asia reported a level of need equal to or greater than 4.0 for the development of EE programs. More specifically, its greatest needs were for programs on the primary, secondary, and post-secondary levels. On the post-secondary level, the training of teachers and other professionals received the highest ratings. Generally, the findings for the Asian region reflected high levels of needs, but not as high as Africa or Latin America. Also bear in mind the population differences between Asia and other regions. The country of India alone, for example, has a larger population than all of Africa and all of Latin America combined.

Latin America consistently had levels of EE needs that were higher than world averages for all educational sectors and across all EE resource categories, except for primary school programs. As mentioned, and a point worth stressing, the African and Latin American regions showed the highest level of need (compared with all other regions) for out-of-school adult programs. Consistent with worldwide scores, we also found that Latin America had given a rating equal to or greater than 4.0 for funds for the development and testing of EE innovations and for trained EE personnel to develop instructional materials and programs for all educational sectors.

Northern Europe reported a need level equal to or greater than 4.0 for funds to develop EE programs on the primary, secondary, post-secondary levels (especially to train teachers and other professionals) and for out-of-school youth programs. This region seems to have the necessary trained personnel and know-how, but it appears to lack the resources to meet its programmatic needs.

Western Europe was consistently lower than the world averages across all EE resource categories. In fact, this region reported no needs with an intensity equal to or greater than 4.0. If the 4.0 criterion were lowered to 3.5, however, a need structure similar to (but less intense than) Northern Europe would emerge, but with a greater stress on out-of-school adults than on out-of-school youth.

Eastern Europe, on the other hand, was consistently higher than the world averages in its need for EE funds, across all sectors except for out-of-school adult programs. The resource needs with a level equal to or greater than 4.0 were for (a) funds for the development and testing of EE innovations for all educational sectors except out-of-school adult programs, (b) EE leadership training for all educational sectors, and (c) EE programs at the secondary and post-secondary levels. On the post-secondary level, the needs were not only for teachers and other professionals but also for students in general.

Southern Europe reported a need for funds that was equal to or greater than 4.0, but this region differed from all other regions in one important way. Southern Europe was the only region to report an intense need for EE legislation. This unique need was reported in relation to funds for EE program development on all levels of formal education, especially for teacher training on the post-secondary level. Thus, Southern Europe's primary needs for EE legislation, funds, and programs were consistently higher than the world averages.

At this point, then, we can generally say that, among other things,

- (1) over 70 percent of the countries studied had "very high" levels of need for EE resources,
- (2) over 80 percent of those countries with "high" levels of need were in the world's less-developed regions,
- (3) most countries appeared too poor to establish EE programs without outside financial aid, and
- (4) most countries lacked sufficient trained EE personnel to assume EE leadership roles and to ensure quality programs.

In a nutshell, then, one could say that although funds are a necessary ingredient in the development of EE programs, such economic assistance is not sufficient to start EE programs. Technical and managerial skills are also a precondition. Like EE funds, such EE skills are also in shortest supply in the less-developed countries. This may not surprise anyone, but the point is that we do not have to guess anymore. More importantly, we know something about the complex structure of each need category, what some of the key interrelationships are, and we can speak on a level as concrete as specifying who it is within the general category of, say, a university that needs EE the most. We can, for example, tell you whether it is (a) pre-service teachers, (b) other pre-service professionals, like engineers, or (c) other students.

How North America Compares

Figure 2 compares and contrasts each of the 7 major EE resource categories for North America with the world averages. As one might expect, North America was generally lower than the worldwide need-levels across most categories. In fact, no need for EE legislation was reported in the North American region. And, as shown, the need for EE organizations and associations, physical facilities, and instructional materials was relatively low.

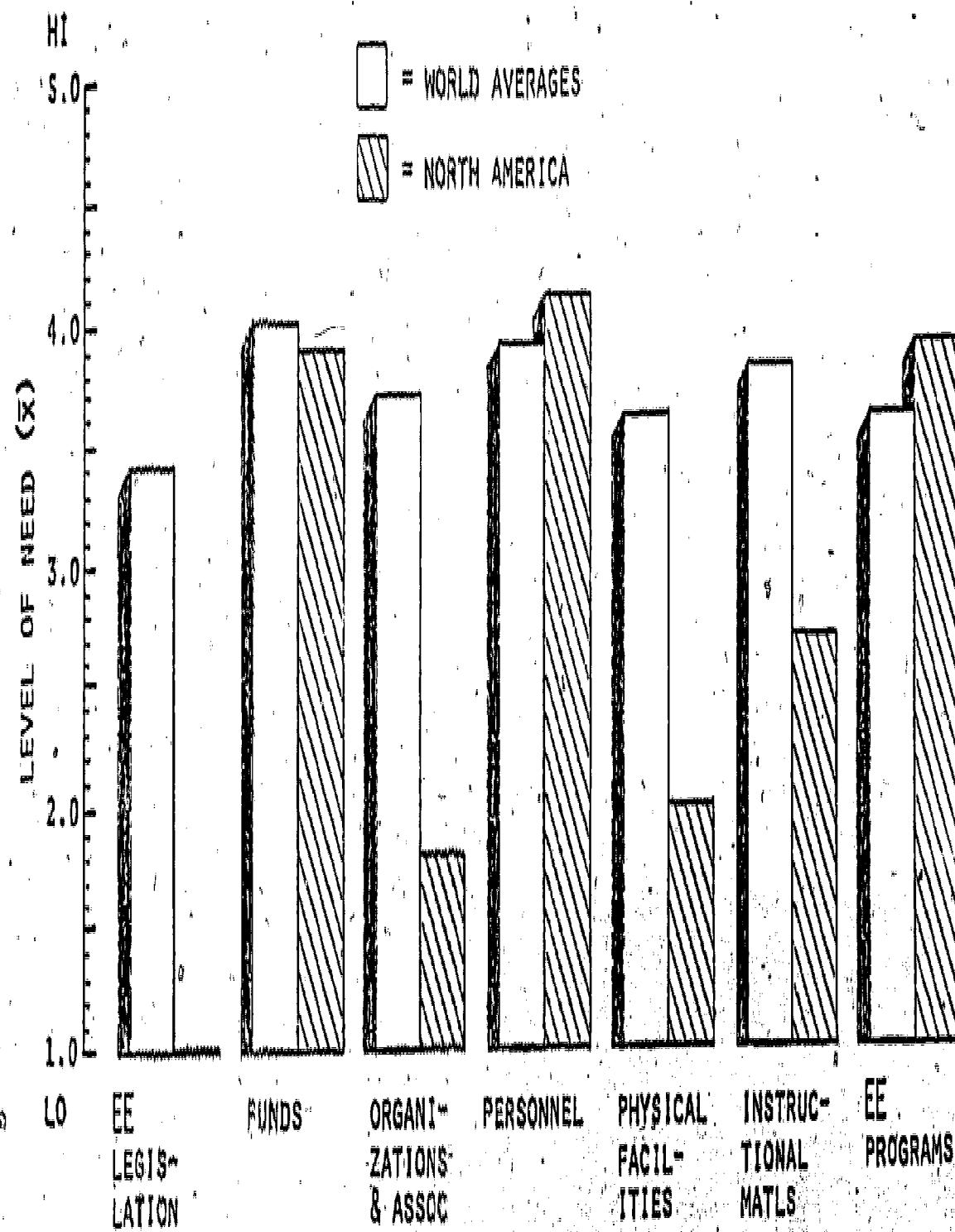
Figure 2 also shows that the need for EE funds in North America was right up there with the world average. This finding surprised many people from other regions who see North America as a super-rich region. What they do not seem to realize, however, is that the great financial wealth within the region is not in the hands of environmental educators. Thus, within the region, there is a great need for additional EE funds to adequately reach EE goals. One could dramatize the situation by saying that where most nations consider themselves indeed fortunate to get pennies allocated to EE, North America perhaps allocates dimes to the task--a task that is going to take dollars to accomplish. It is not a matter of funds per se, then, it is a matter of how they are allocated, a matter of priority. And priorities mirror values.

And since we all have to eat occasionally, the quantity and quality of EE personnel was related to available EE funds. In North America, the need for trained EE personnel stretched across all educational sectors. And, as shown by Figure 2, in order to meet the need for EE programs, then, you must have competently trained EE people who have the required funds to capitalize on the existing physical facilities and instructional materials and media. And as mentioned, the need for physical facilities and instructional materials, as well as for organizations and associations, was relatively low.

Since all of the input and operational factors listed to the left of the "program" category in Figure 2 are blended in order to produce an EE program, it makes sense that an unmet need in any of the input or operational factors would affect the level of need in the program category. Please keep in mind that all of the elements shown, and some not shown, interrelate in some very complex ways and that our intent here is only to draw attention to some of the most important EE resource-needs as reported by UNESCO member states.

FIGURE 2

COMPARISON OF 7 MAJOR EE RESOURCE CATEGORIES FOR NORTH AMERICA
WITH WORLD AVERAGES, WITH ALL EDUCATION SECTORS COMBINED*



*The combined education sectors are: Pre-School, Primary, Secondary School, Post-Secondary (or Higher Education), Out-of-School Youth, and Out-of-School Adult Education.

Again referring to Figure 2, note that it statistically combines the scores for pre-school, primary, secondary, and post-secondary education. It also includes out-of-school youth and out-of-school adult scores in the same columns. At this point it would not be very useful to break down Figure 2 into its six now-combined sectors because the need structures for each of them were very similar, with one exception.

In Figure 3, we have split the deviating sector from the others. As shown, the need for EE programs for out-of-school adult populations reached an unusually high level. This makes sense, of course, in light of the apparent high level of general public "awareness" of environmental concerns in North America--of being defined as just a general consciousness of a situation, but without any direct attention to it or definite knowledge of its nature. After the smoldering public concern about environmental abuses caught fire in the early 1970's, public awareness climbed rapidly and now seems to have leveled off, especially in North America and Europe. In many other regions, however, such awareness is just now beginning to spread widely (cf. Roth, 1974).

But, as all good EE educators know, awareness is only one step (although critical) in the long problem-solving process of becoming knowledgeable about problems, developing attitudes about them, and engaging in the process of learning how to actually change the situation. Sooner or later we must draw each of these aspects into our net. Awareness, then, precedes the other steps as a necessary but not sufficient condition to effective environmental problem-solving. Our research shows a rather strong need in North America for out-of-school adult programs that encompass all phases of environmental problem-solving, a need that is not being adequately met in North America.

What the Findings Mean

The term "meaning" can encompass at least five aspects. That is, we can talk in terms of (1) the intent or purpose of reporting such research findings, (2) what kinds of realities they designate or refer to, (3) what they define or translate into, (4) what caused them, or (5) what their effects on the future might be.

Rather than attempting to deal with each of these five aspects of the term "meaning" in a serial way, they will be lumped together more loosely and some of the more substantive issues will be pinpointed. To help decipher what the findings mean, however, it will be necessary to identify some of the larger problematic aspects of the world system that contribute to the patterns the findings have taken.

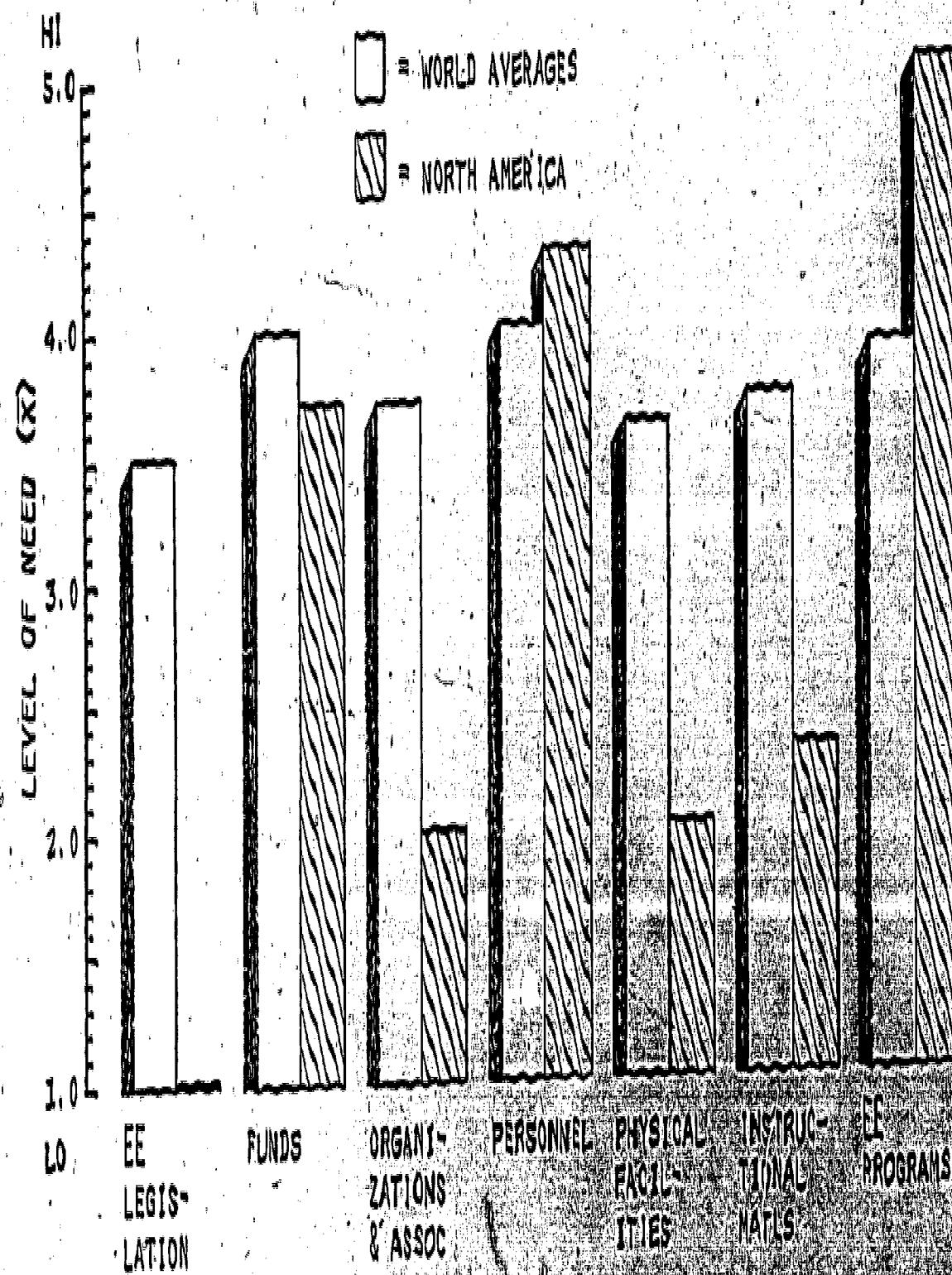
In a paper presented earlier this year (Horn, 1978), I elaborated five major themes that reflect recent thinking about world-development problems and the changing strands of the world's socio-political fabric. And it is these problem themes that provide the context for conducting a worldwide EE needs assessment. Without adequate elaboration of a problem context, it would be nearly impossible to accurately decode the meaning of the data gathered.

Therefore, not only are there some important variances in the needs for EE resources among various regions, but there is also a much larger template of themes or crosscurrents superimposed over any international effort to measure, evaluate, and satisfy those needs.

The first theme concerned a recent shift in the meaning of the term "national development"--especially in the less-developed countries. Although the commitment to national development has been worldwide, its meaning has been shifting beyond the materialism and aggregate growth objectives which dominated the now outmoded models of socio-economic development. The new models include such multiple objectives as sustained improvements in the quality of life, more equitable participation in the benefits of development, the elimination of acute poverty, and higher employment rates.

FIGURE 3

COMPARISON OF 7 MAJOR EE RESOURCE CATEGORIES FOR NORTH AMERICA
WITH WORLD AVERAGES, FOR OUT-OF-SCHOOL ADULT EDUCATION SECTOR ONLY



The conventional highly-materialistic and environmentally-damaging model of development, moreover, has been shown to be generally inappropriate for worldwide development. But when dealing globally, to be sure, we must begin to "accept the diverse models of economic and political development that the less-developed countries have chosen to benefit their peoples" (Lake, 1977, p. 3). But certain human rights do perhaps have universal application, such as the right of each human being to have a more equitable share of our planet's natural resources.

The second theme was the shift away from an over-emphasis on high-level, capital-intensive communication and education technologies--again, mainly in the less-developed countries. Although high-level technologies clearly have their place where certain preconditions are met, other middle-range technologies seem more appropriate for meeting the prime objectives of a more equitable national, regional, and global development strategy.

The third theme reflected the growing concern in some regions about the high degree of dependence of some nations on others. Such concerns have brought about a reexamination of the production and distribution of some communication and education materials and media. Pushed to its extreme, cultural dependency is often said to be like having to brush your teeth twice a day when you have nothing to eat. Such extremes aside, at its base, this concern reflects the emergence of new non-colonial patterns of socio-cultural development worldwide. These new patterns place higher values on national self-reliance and self-determination.

The fourth theme elaborated the idea that much of the imported communication and education materials and media used in some countries have been increasing the socioeconomic gaps among the various social strata within some nations, and between the urban and rural populations, especially in less-developed countries. While part of the original assumption was that the imported media would narrow the gaps through what has been called a "trickle-down" theory of development, some recent research indicates that the imported media may be contributing to the widening of gaps (cf. Rogers, 1976; Schramm and Lerner, 1976).

The fifth theme I elaborated in my earlier paper drew attention to the now-global concern about the relatively low degree of local participation in some national and international development efforts. The old "top down" approaches, in which local citizens (or entire nations) were in effect told what their problems were and then persuaded to follow certain specific lines of action to solve them, are now obsolete. Consequently, national and transnational communication strategies have been shifting toward less directive roles to "assist" in what should become a democratic self-development process.

Each of the above five themes and their elements, to be sure, are dynamically interconnected with one another as well as with many of the assumptions underlying alternative EE strategies between and within nations. The major point is that the international development experiences of the last few decades (particularly in less-developed countries) have taught, or should have taught, national and international environmental and EE problem-solvers and policy-developers many lessons. The central lessons are (1) that there are apparently many alternative yet valid pathways to national, regional, and global development; and (2) that there are, therefore, many alternative yet valid forms of EE which are likely to emerge.

EE and National Development

Some of the questions the less-developed countries will be asking about EE will concern the relationship between EE and overall national development. While in North America the stress (at least in the formal education community) has been on what EE can do to upgrade formal education, the question the less-developed countries will perhaps be asking more often is what can EE do for overall socio-economic development.

In some ways, there are significant differences in the most popular North American brands of EE and the kinds needed to best meet the indigenously determined goals of many less-developed countries. Only a few of those differences, however, will be identified below.

Since most people in less-developed regions spend their time and energy attempting to meet their most basic physiological needs (cf. Maslow, 1970; Watt and others, 1977, pp. 101ff), EE programs in those areas are going to have to help meet those needs (cf., for example, Faure and others, 1972; and OISE and UNESCO, 1975). We know that an entire organism is involved in the gratification of a strong need, so a hungry person is very unlikely to find the kinds of EE activities usually listed in North American curricular guides relevant. There are some exceptions, of course. The very small privileged groups who live in sections of urban areas in many of the less-developed countries, for example, attend schools very much like those widespread in North America. So the content and approach would be much more meaningful to them. But they are the small minority.

Many EE programs in North America are very highly urban-oriented, and rightly so, because that is where the greatest needs have been, and that is where most North Americans live. Most less-developed regions, on the other hand, are predominantly rural in character. And they are working very hard to prevent the migration of people from the agricultural lands to the already overcrowded urban centers. To help narrow the urban-rural gaps, then, and to improve the rural areas so people will want to stay there, EE programs in most less-developed countries are going to have to be rural-oriented. About 77 percent of South Asia, for example, is rural. It is almost the reverse situation in North America.

In order to benefit the vast majority of humankind, EE programs in less-developed countries are going to have to put a very heavy stress on increasing rural food production, better nutrition, preventive health, and a more practical education (World Bank, 1975, p. v). EE programs will have to be much more closely related to employment and to the work-place environment (rural or urban) of a labor-intensive job market.

Poor farming practices, which may significantly contribute to the problem of excessive particulate matter in the atmosphere, might be a place to start a problem-specific EE program in, say, South Asia (cf. Russell and Landsberg, 1972, p. 50). EE program strategies have to be localized, then, because educational objectives arise from a country's norms and cultural values which are quite diverse worldwide (cf., for example, Horn, 1965). For instance, in North America formal education is very decentralized and religion is non-governmental. In many other countries, on the other hand, education is nationalized and in some cases there is a strong national Ministry of Religion. These different arrangements reflect different cultural values just as the content and orientation of EE programs in North America reflect North America's norms and cultural values (La Belle, 1973; Buzzati-Traverso, 1977).

What I have chosen to call the "EE effects gap" is also an increasing concern in less-developed countries. Will the effects or the impact of a given EE program serve to widen or narrow the socio-economic gaps within a country or region? Will the benefits go entirely into the urban centers, making them better off but leaving the rural poor the same, and therefore further widening the socioeconomic gaps within a nation? To be consistent with international trends, then, the potential "EE effects gap" of each multinational project must be reviewed. And, just as environmental educators advocate the use of environmental impact statements for evaluating the consequences of, say, a new housing development, it will not be long before environmental educators will have to submit environmental impact statements along with EE program proposals. Included in those impact statements, of course, will be the social consequences of a program too. Thus, learning how to write EE impact statements is a top priority.

EE Technology Transfer

The problems of international transfer of EE technologies will be a major concern to the international EE community for many years to come. "EE technology," to be sure, is defined here broadly to mean the collection of EE strategies, concepts, tactics, techniques, materials, guidelines, and so forth, which has had some demonstrated usefulness somewhere in achieving EE goals. Technology means much more than just tractors and computers, and we are slowly learning that various intellectual conceptualizations are also powerful technologies which can have devastating impacts on people as well as their environments. Thus, when one thinks in terms of "appropriate technologies" (as in Schumacher's writings), we must also include appropriate EE technologies. Indeed, it was not by accident that the new UNESCO-UNEP International EE Programme is housed within the Science and Technology Education Division of UNESCO.

When a strong need for a particular EE resource is sensed in a less-developed country, for example, at least two key messages go out. The first message asks what innovations already exist which can meet the need. The second message asks what kind of development or experimentation should be done to meet the need. The first is usually called "knowledge scanning" and the second is called "knowledge production" (Havelock and others, 1974). In the case of North America, there is little doubt that there is a large chunk of North American EE technologies which is truly superior, for those who need them. And one way to help lessen the imbalances among nations is to spill over EE technologies from North America where appropriate, thus helping to balance the scales among nations. But, to give people technologies where their needs are not, is like scratching where they do not itch.

However, one simply cannot transfer EE as it is commonly packaged in, say, North America to the less-developed world. Within North America, an EE innovation can often be transferred from one state or province to another by "dropping" it into some current social organization, which evaluates it, and then decides whether or not to adopt it. That is, the context is such that only the innovations to less-developed regions commonly require different strategies because before the innovation can be adopted (or adapted) an entire organizational infrastructure must be brought into existence as a context for receiving, reviewing, adapting, diffusing, etc., the innovation. The system of organization is often not there; or if it is, a suprastructure for implementing the innovation is not.

The mobilization for EE on the local village level in most less-developed countries, then, will likely require some new EE models. The dominant models in North America seem (a) too complicated and (b) too professionalized for widespread implementation throughout many regions of the world. Moreover, the dominant North American models are (c) too material-resource intensive. A rural village in a less-developed country would more likely need an EE program design that can be implemented by village volunteers without large quantities of paper, instructional aids, and the like. Moreover, the impact of the program must be made visible and immediate to have village-level acceptance. The benefits of most North American models seem (d) too obscure for village acceptance. The dominant North American models are also (e) predicated on high levels of individual and governmental income and therefore, unlikely to work where those preconditions are nonexistent.

Therefore, in no case should there be an uncritical transfer of one region's conceptual frameworks and methodologies to another region. There are those at UNESCO who are very concerned about this and who are working on the development of guidelines for the appropriate transfer of EE-type technologies. In sum, "While our policies must be global in their concept, their implementation must be specific to each situation. Policies must be tailored to take into account the great diversities that exist among the developing countries" (Lake, 1977, p. 2).

There is, however, a definite place and role for the transfer of EE technologies between regions. But the emphasis should be placed on (1) critical and intelli-

gent adaptations and (2) local program generation (for example, see Horn, 1971). Certain ideas will inevitably travel back and forth from one region to another and be modified on each trip. This is desirable. The rule and guidelines, then, is that a country should invent or adapt, not adopt, another region's EE models, materials, or media. Such a guideline can even apply within North America, but the consequences of not applying it from region to region are just magnified manifold. Cross-culturally there are many more pits to fall into (cf. Samovar and Porter, 1972; Sitaram and Cogdell, 1976).

Thus, it is likely that many of the North American brands of EE would have to change gears in order to meet the needs of people living beyond the richer urban centers in less-developed regions. A nagging question that needs to be asked, then, is to what extent, and in what aspects, is the current range of EE models in North America cross-culturally valid? Although we have had some Masters degree students interested in this concern (for example, Kemperman, 1973), I would like to get some of our doctoral students to really dig into the question.

In conclusion, then, let me say that I have tried to touch upon some of the possible meanings and implications of the findings of our recently completed study of 136 countries. I will leave you with three major guidelines for future EE program development within North America as it relates to what has now rightfully become a worldwide EE Movement.

World EE Guidelines for North America

First: We can best help the world EE Movement by helping put our own house in order by scaling down our wants to what we really need. The Chinese have a saying that "Those who know when they have enough are rich."

Second: We can best help the world EE Movement by learning to better globalize the EE materials and media we use in North America to reflect a much wider range of alternative views of the world and alternative futures. Although it has already been demonstrated that educational systems have an important role in creating world images (see Saarinen, 1976; Remy and others, 1975), our EE programs need to address more candidly the international flow of raw materials and the resulting international policy dilemmas (see, for example, Lake, 1977; USDS, 1976).

Thus, a new goal of EE in North America could perhaps be to develop a less parochial view of humankind. In this way, North American EE, as an agent of change, must also become the object of change. Unfortunately, the current trend seems to be that instead of EE people increasing their interest in global affairs, we are seeing an increasing interest on the part of global affairs experts in EE. This, of course, is desirable, but it must become a two-way street (cf. Hansen, 1974).

Some of the specific things we need to do are (1) to content-analyze our current EE materials and media for more-balanced views of global environmental problems and the range of alternatives available to solve them; (2) to identify the global EE policy-dilemmas and inconsistencies and add our best intellectual thinking to their understanding; (3) to contribute to the public debates. When we view the environment and EE from other world viewpoints, and when we try to help others, we realize how culture-bound many of our assumptions are, and we grow in the knowledge and experience to improve ourselves and our children. Bulletin 47 (by Remy and others, 1975), published by the National Council for Social Studies and the Social Studies Development Center's bibliography (by Basa and Codianni, 1975) are perhaps good places to begin. You might also want to consider joining the new Internet program (see SEP and UNESCO-UNEP, 1977).

Third: We can best help the less-developed countries of the world by helping them design and produce their own EE models, materials, and media. A major problem for less-developed countries will be finding the quality and quantity of EE expertise they need in almost every aspect of their EE program planning, development, and implementation.

As Hindu wisdom has told us for centuries, "Help thy brother's boat across, and lo! thine own has reached the shore." This means that you could make yourself available as a Peace Corps Volunteer, a United National Volunteer, or as an international EE consultant to travel to and work in one of the many curriculum development centers around the world. The idea is to help people help themselves. Those who have participated in such a way claim it to have been the most significant educational experience of their lifetime. At UNESCO, we have a saying: "Allah does not subtract from one's life, those days spent doing environmental education."

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FOREIGN STUDENTS AS AN EDUCATIONAL RESOURCE IN AN UNDERGRADUATE ENVIRONMENTAL STUDIES COURSE: AN EXPERIMENT

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INTRODUCTION

No environmental studies program is complete if it does not include some analysis of the international scope of environmental problems. This analysis can and does take many different forms depending on the orientation of the program, the resources of the college or university and the abilities and imagination of the instructors. The focus, however, is almost always on the delivery of "factual" content; i.e. population dynamics, economics, resource base and utilization, food problems, etc. Some of the more innovative courses attempt to explore topics such as technology transfer; appropriate technology, and, if anthropologists are available, cultural diversity and cultural adaptation to the environment. Instructors are usually Americans or are at least from what we might call "first-world" countries. Therefore, even in the best courses, the content is delivered with a "first-world" perspective.

Our consideration of the international scope of environmental problems should include some exploration of the environmental perspectives held by the people in cultures other than our own. American instructors, no matter how well trained or experienced they might be, cannot provide this perspective. In order to get foreign perspectives on environmental problems we must bring our students into contact with foreign nationals - persons who have been raised in other cultures and have been socialized by these cultures.

This paper describes an attempt to utilize foreign students as the principal sources of information in an experimental course on Perspectives on Environmental Problems. The purpose of this experimental course was to explore attitudes towards the environmental problems by the people living in these countries. The purpose in using foreign students as information sources was to demonstrate the value of this tremendous reservoir of human experience which is present on most college and university campuses.

Our aim was not to attempt to solve world differences nor give the student a false sense of gaining the total picture of even the representative countries. Rather, our goal was to begin to facilitate a new sensitivity to different cultural perspectives while fostering a direct dialogue communication network between U.S. and foreign students.

PROJECT ORGANIZATION

The experimental course project was organized and coordinated by a student committee appointed by the Environmental Studies Office at Iowa State University. All members of the student coordinating team were upperclassmen in environmental studies and native midwestern Americans. The Coordinator of the ISU Environmental Studies Program served as official sponsor for the project and as the "professor-in-charge" of the course. This latter role was purposefully low profile and advisory. The coordinating team was given considerable freedom to develop their course content and format. The project was organized into developmental stages: 1) Early Planning; 2) Content Development; 3) Implementation, 4) Results, and 5) Evaluation.

PREPLANNING

Since a major goal of the project was to involve foreign students as the principal sources of information for the course, our initial step was to solicit the cooperation and assistance of the University Office of International Educational Services (OIES). Initial meetings between the student coordinating team, the course sponsor, and representatives from the OIES were held to develop goals, requirements, and educational philosophies for the course.

From the start, OIES support for our efforts to bring American Students into contact with foreign students was enthusiastic. Two reasons for this support were cited:

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- 1) Foreign students are faced with immediate isolation when they enter a U.S. university. Since their only real means of identification comes from within their national groups, these students tend to remain outside the mainstream of American college life. Relatively little interaction occurs between American groups and these national groups. Our course would provide an opportunity for this type of interaction.
- 2) Most U.S. students are unaware of the importance of understanding differing value systems and beliefs. What members of other nations think and do is vital to the United States. Few American students understand how dependent we are on other countries. We have developed complacent attitudes towards our relationships with other countries because we have tended to develop biased, oversimplified perceptions of people from other lands and cultures.

In spite of numerous attempts to bring U.S. and foreign students together, the OIES has experienced difficulty in attracting American student involvement. For this reason, they believed that a course such as we proposed to organize would contribute to their program objectives. They also cited the importance of cross-cultural communication as an educational tool, noting that "there is a multitude of knowledge just waiting to be tapped, but no department has really taken advantage of the opportunity." They also believed that U.S. students would find the foreign students to be very interesting.

The foreign student participants were selected by the OIES using criteria for selection developed by the student coordinating team. The main criterion used was interest in participating in such a class. Geographical location of native countries and educational background were also considered because we wanted to obtain a diversity of backgrounds and interests.

The seminar was prepared during winter quarter and presented during the spring of 1978. During the winter quarter, 4 weekly discussion sessions were held between the foreign students (approximately 20) and the coordinating team. One major concern at this point was the role that the coordinating team would play in the first quarter sessions. After consulting the course sponsor, they decided that the role of the team would be to organize the discussion sessions, facilitate free discussions during the sessions, and provide an American perspective on environmental problems. The idea was to allow the foreign students to develop freely their material within the guidelines set for the course. We later found that the foreign students were very willing, even anxious, to develop their presentations to follow the course guidelines developed by the coordinating team.

The goals established for the four discussion sessions were:

1. To give the foreign students insight as to how the ISU environmental studies program was organized, what educational philosophies were involved, and what American students had been discussing in previous environmental studies classes.
2. To explore the similarities and differences in views of the environment and environmental problems.
3. To determine which problems would be examined in the full course during the Spring quarter.
4. To discuss the format and structure of the spring quarter course. Discussions centered on the foreign students' responsibilities in the seminar and how they would present their material.

At the conclusion of these sessions, the coordinating team decided that the foreign student presentations would be grouped on the basis of geographical regions: Africans, Middle-Easterners, Latin Americans, and Asians.

IMPLEMENTATION

The spring quarter course was run as a seminar. The class met one evening a week for ten weeks and each session lasted 1.5 hours. Students received one credit for the course. Grading was on a pass/fail basis with the final grade being determined by the course sponsor after consultation with the coordinating team. Grades were based on class participation and contribution to the group papers described below.

The first five sessions of the seminar, devoted to foreign student presentations, included approximately 30 minutes given to mini-lectures that dealt with the foreign students' views of the major problems facing their societies. For these mini-lectures, the class was divided into small groups, the number of groups being determined by the number of foreign students presenting material that particular evening. At the end of the 30-minute small-group session, the class reconvened to discuss the problems presented in the mini-lectures. The foreign students led these discussions.

After the fifth week the class was divided into 6 workgroups. Each group included four or five American students and one or two foreign students. The groups were responsible for preparing group papers that addressed and appraised U.S. foreign perspectives with respect to world problems.

To allow ample time for the preparation of these papers, the class did not meet in the sixth and seventh weeks. The final two weeks of the course were devoted to a discussion of the roles that people from both developed and developing countries must play in solving world problems and on an evaluation of the course and the use of foreign students as resource people.

RESULTS

1. Environmental Quality is Assigned a Low Priority: A consistent message from the foreign students during this course was that, while concern for the environmental quality certainly existed in each of their countries, preservation of environmental quality was assigned a very low priority. In rating the major problems facing their societies and governments, the foreign students placed political independence and stability first, followed in order by education, food, health, population problems, and the transfer of technology from the more developed nations. The improvement of education and the supply and distribution of food, the provision of adequate health care, and the acquisition of appropriate technologies were cited as "direct" problems associated with social and economic development. Political problems and population distribution were cited as "indirect multiplier" problems which exacerbate the "direct" problems and hinder efforts to find solutions.

Political stability and at least the illusion of freedom were considered to be prerequisites for the development of a sound social system. Political instability breeds economic insecurity, scares away foreign investment, and funnels a disproportionate amount of the nation's "wealth" into non-productive ventures such as arms purchases. Autocratic rule may provide some degree of political stability but corrupt autocratic rule may divert scarce national resources and funds into private goals for the powerful few. Until the political problems of a developing nation are resolved, advancement toward solutions for other social problems will be halting at best. In such situations, concern for the environment does indeed take a back seat.

Imbalances of population distribution created by continuing massive migration to the cities alter the production-consumption system in developing countries. Growing urban centers become consumption sinks, increasingly draining physical, agricultural and human resources from the areas of production - the rural countryside. Long-standing, adaptive social and cultural patterns break down and are replaced by new patterns dictated by the new conditions, especially new economic conditions. Crowding in the cities leads to unemployment, a decreased

sense of personal worth, malnutrition, disease, crime, despair, and a tragic loss of human potential. It is easy to see how the urbanization process functions as a multiplier factor for other societal problems.

A close look at examples of the major problem areas reveals that these problems are not only individually complex and difficult, they are also highly interrelated. For example, in the area of food supply, we learned that the distribution of food is affected by urbanization, the creation of "demand" and the development of a cash economy. Growing urban centers create a "demand" for food. This "demand" is met by purchasing food from rural farmers. Thus, a cash economy is often installed in place of traditional barter-type economies. One of the African students described the problem:

Before this emphasis on cash crops, people of the villages where the crops were grown would keep a supply on hand in the village to last until the next harvest. The rest would be bartered for needed items, such as clothing and housewares. Only excess food was bartered and this went for tools, clothing and essential items. Since the initiation of cash economy, however, much of the harvest is sold for cash. The desire to maximize profits motivates the farmer to sell as much of his crop as possible. The crops are shipped away, most of them to the major urban areas where the demand is greatest (a result of massive migration to the cities). As a result, inadequate food supplies remain in the villages.

The cash received by the farmer is often spent on such luxury items as candies for children, extravagant clothing and liquor. When supplies of food remaining in the village run out, quite often so has the money and the people are left with the problem of scraping together enough food to make it to the next harvest. Even if the food returns (after processing), it does so at a price often too high for the farmer to afford. The increasing demand for food for the urban masses will ultimately place a severe strain on the agricultural ecosystem and on the health of the rural citizenry. Failure to satisfy the food requirements for the cities will likewise be reflected in lowered health conditions and a further degradation of the urban environment.

Of course, we recognize each of the problems - political, population, food, economic, cultural, health, etc. - as components in any systems view of environmental problems. In the U.S. and other first-world countries we have the luxury, made possible by political and economic stability and by an ample resource and food supply, of concerning ourselves with such abstract concepts as environmental quality. Even in our own society, however, we see that when even the "necessities" seem threatened, concern for environmental quality suffers. Thus, it is easy to see how concern about the quality of the environment would be assigned a low priority in sectors of the world where basic social institutions are stressed and where even survival may be a day-to-day affair.

II. American Students Reexamine Their Roles: We had hoped at the beginning of the seminar that the participants would gain a new perspective from which to view world problems. In the majority of the group papers a great deal of emphasis was placed on a new 'first-world' (U.S.) view of 'third-world' countries. This was perhaps the most intriguing development during the seminar and it spawned a great deal of discussion concerning a "new" role and what it might involve. This redefinition involved a belief that the role of the first-world nations, in particular the United States, should be that of a "helper" and NOT a "giver." This new role was summarized in one of the group papers: "If the smaller (third-

world) nations are going to develop and solve world problems, they must have help to help themselves, not handouts!"

The groups also listed some changes that they thought were necessary in order to facilitate this new 'first-world role':

- 1) There should be no interference with internal structures of the developing countries' cultures.
- 2) We must become aware of needs, values and attitudes before providing aid.
- 3) We should provide technologies appropriate to the needs of the developing nations instead of trying to develop new markets for our most advanced machinery and hardware.
- 4) Our economic ties with developing countries must be mutually beneficial. This would include giving them a fair price for their resources and goods.

This idea of a new role was a recurring theme during the course. A plea for a redesigned approach to foreign policy on the part of the U.S. and other first-world nations was eloquently offered by a student from Africa:

"Only when two people can sit down face to face as two people with love and mutual respect for another, rather than as representatives from opposing sides, will it be possible to begin settling international disagreements.
Hilton Ballor (Sierra Leone).

EVALUATION

Evaluation of the course was obtained by extracting critical comments (both positive and negative) from the group papers and by administering an evaluation questionnaire at the conclusion of the spring quarter. In the questionnaire the students were asked for their overall view of the approach taken in the seminar, for comments on what they had learned and about the use of the foreign participants as an informational resource. Some of the comments from American students were:

"Having the foreign students give class presentations of their countries was a far better teaching and learning experience for the class, as opposed to listening to an instructor lecture on the material."

"I expected to see more emphasis on pollution, etc. I was glad to see this new dimension of comparing world environmental problems presented."

"Much of the news printed about the third world is not important or is one-sided. The true needs of the third world are unknown to most Americans."

"Problems are not universally consistent. We need to change our own attitudes towards developing countries by changing our own value systems."

"I learned that there is so much more I have to learn! I am only starting to understand the complexities involved in trying to understand another country's problems."

Some of the comments from foreign students were:

Addulrahaman Zerti (Libya), "Keep doing this. It is a good idea to build understanding and trust and love between Americans and Foreigners."

Hilton Bailor (Sierra Leone), "The entire seminar was very valuable and should be made available to as many people as possible."

Gete deRosa (Brazil), told us that he is actively getting other Brazilian students interested in becoming involved with such a program.

The participants seem to have accepted the fundamental purpose of the seminar with enthusiasm. This enthusiasm was also seen in support of the use of the foreign students as an educational resource.

"I thought the seminar was a good one. I think the contact with foreign students is a must in environmental education."

"The seminar would have been worthless without the views of the foreign students."

CONCLUSIONS

This approach has a great potential for expanding the impact of environmental education. The students that participated repeatedly expressed the desire to see the program continued. Through their comments we have been able to develop some general conclusions about this type of approach:

1. Cross-cultural experience in dealing with global problems can and should be incorporated into environmental programs.
2. Foreign resource people provide new insights and thoughts. This offers the U.S. student a better understanding of other cultures.
3. The foreign students also gained a great deal from these interactions.
4. Communication is the most important factor in generating cooperation.

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URBAN ENVIRONMENTAL EDUCATION IN GREAT BRITAIN

John O. Towler¹

The British approach to Environmental Education allows a high degree of individual involvement in environmental activities and an enviable freedom for teachers to initiate and develop new programs, courses, and approaches. One of these new approaches is the development of Urban Studies Centres. These grew out of the realization that while the rural outdoor education centres were extremely popular and heavily used, students were receiving a biased view of the environment, one which emphasized only the rural aspects even though some 80% of the population was living in urban areas. One of the earliest mentions of urban studies centres was contained in a 1972 report on the human habitat. This report entitled "How Do You Want to Live?"² was based on a study of public opinion undertaken in connection with the United Nations Conference on the Human Environment. The authors recommended that "Consideration should be given to the establishment of urban studies centres for environmental study, along the lines already familiar in countryside study."³ This idea was quickly followed by several articles on the topic and a text on the methodology for transferring expertise in rural field work to urban "streetwork." At the same time, the Town and Country Planning Association (TCPA) created a Council for Urban Studies Centres. This Council was instrumental in helping to further the idea of urban study centres and in assisting groups wishing to start them.

The centres were patterned after the existing residential field studies centres which provided a full-time warden or teacher/administrator, a number of teaching assistants and a variety of facilities and equipment which allowed students either to take courses prepared by the staff or to do independent work. There was not, however, an exact parallel between what existed in these rural centres and what was required for the urban areas. It was felt that since the urban centres would be located in areas of high population, they should also be used to provide community services in addition to their more traditional formal education functions. Residential facilities were not considered to be a high priority since these would not be in as high demand as they would be in rural centres which are usually situated in areas not easily reached by the users. In addition, the cost of acquiring residential facilities in an urban location would probably be prohibitive.

In creating the study centres, the Council identified seven major purposes or goals. These were:

1. As a learning base for secondary school and older students visiting the town or city. With an increasing amount of time being spent on urban studies in the schools, it was felt that students from rural and urban areas needed a facility with room for class meetings, work areas and resource materials to support the work already in progress.
2. As a centre serving visitors to the area, both young people and adults who were not part of the formal educational process. In this case, the function of the centre would be to provide interpretation of the "built environment" to tourists and other visitors through exhibitions, slide-tape shows, book and map sale departments, etc.
3. As a teaching resource centre concentrating materials and aids to help visiting teachers and providing expertise concerning the local environment through the staff on the centre. Such a collection of resource materials and knowledge would be larger than that gathered by any local school or public interest group.

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²How Do You Want to Live?, London: Her Majesty's Stationery Office, 1972.

³Ibid., p. 181.

4. As a learning base for local secondary schools, supplying the resource materials for a study of the local urban area and at the same time providing an institution and location alternative to the conventional school. It was expected that the centre would act, in a specialized subject area, along the lines of already existing Teachers' Centres which are cooperative ventures for teachers in a region who wish to work on some aspect of in-service professional development.
5. As a centre through which local authorities, particularly the local planning authorities, could disseminate information about the local environment to the school and adult populations. It was also intended that the centre would function as part of the public consultation process concerning the urban area. This two-way communication between the public and planners and architects is mandated by British law. It was felt that the urban studies centre might provide a neutral ground for such discussions. Centres could also be used by interest groups for the objective education of the parties involved in the planning process.
6. As a venue for community forums and as a place where local amenity groups and unofficial bodies might hold meetings and obtain some minimal secretarial assistance.
7. As a specialist institution which could meet the need for certain introductory and extension courses for environmental professionals and local counselors.

As of 1974 there were no urban studies centres in Britain. However, within two years there were 26 centres either in full operation or in the final planning stages. Since then, even more centres have opened and there is no doubt that the urban studies centre concept has taken hold and increased in popularity with teachers, students, the general public, and local authorities. A closer examination of a typical centre, its facilities and program may serve to explain why this concept has been so successful and what makes it such an exciting innovation in environmental education.

It must be said at the outset, that there is no such thing as a "typical" urban studies centre. The location, physical facilities, programs, and leadership vary greatly. Most centres contain some form of auditorium capable of holding class-size groups for the purpose of lectures or audio-visual projection. There are normally one or two classrooms, a workroom for the preparation of materials, an exhibition area, an archive or library to store reference materials, and a canteen where light refreshments can be bought or where lunches may be eaten. Washrooms are always available and some centres have included darkrooms, overnight facilities, and parking areas.

A "normal day" at an urban studies centre might include the following. Two classes of secondary school students from different schools are in the auditorium being introduced to the local urban environment that they will be studying. They are viewing a slide-tape program developed by the centre's staff. Later, the classes will split up, going off as Town Trackers on one of the town trails. The maps and descriptive brochures for the trails will be supplied free as they are to any tourist or visitor. There are four trails available dealing with the historical development of the town, its newly-planned areas, its commercial development, and the architectural features of the new and old buildings. Later in the day, the classes will return for lunch and an examination of the exhibit on current planning issues involving the town. After this, they will work on their reports, relying on the reference material at the centre and on the help of the staff. A highlight of the afternoon session will be a short talk given by a senior citizen who has lived in the town for many, many years. His views on the development of the town will be very interesting, and the students will have an opportunity to question him at length. After a visit to the centre's bookstall, the classes will depart for their home schools.

During this "normal day", the centre will have been open to visitors and a number of tourists will have dropped in to see the exhibits which are changed every few months. The one on display deals with a very controversial planning application which proposes the tearing down of a block of inadequate housing and the construction of a shopping mall and car park. All sides of the issue are presented and notices are posted advising of a public meeting in the centre this evening in which the development firm, the local planning authority, members of the downtown businessmen's association and a local ratepayers group will be on hand for a panel discussion on the proposal. While the centre is officially neutral on such issues, the warden of the centre is especially interested in this public meeting since the businessmen's association will be presenting the results of a public opinion survey that was done by one of the school classes visiting the centre.

While the students were out on the town trails, the classroom and workshop areas were being used by a group of teachers who had elected to spend this time at the centre as part of a professional development day. They will be working on materials and methods for a course they are developing on sensing the urban environment. They are interested in having their students use the centre as a base from which they will do streetwork in the local environment, concentrating on becoming more aware of urban features. They will have their classes use all their senses to investigate the area. The teachers are building reporting skills into the course and their students will be required to do some investigative reporting involving tape-recorded interviews and photographic records of certain man-land relationships.

While this is a hypothetical day at an urban studies centre, all of these activities, and more, regularly take place. The different locations, emphases, and facilities of the centres help to make them unusual and stimulating. The one in Bristol, for example, is located in the Old Corn Exchange on Corn Street. The one in Canterbury occupies part of the Canterbury College of Art. The Chester Heritage Centre is the county's first centre for architectural heritage interpretation and is located in a former church in the heart of half-timbered houses and stores which date back 500 years and more. The Faversham Centre has been set up in cooperation with the local heritage society and is situated in a building that was a public house for 275 years before becoming an urban studies centre and museum offering (among other services) guided tours, books on the history of the area and a souvenir shop selling local crafts. Other centres are associated with Youth Hostels, public interest groups, Teacher's Centres, senior citizens' leisure centres and local planning departments. The facilities range from space in modern buildings to old Victorian houses, churches, and downtown shops.

There is no doubt that the British are doing a great deal of innovative work in the area of urban studies and that the creation of the urban studies centres concept has been instrumental in carrying this form of environmental education to both the schools and the general public. In addition, the TCPA has been both a driving force in stimulating the development of the centres and a continual support in providing assistance for the work that takes place at them. Since this approach to urban environmental education is proven, popular, and needed, we should be asking ourselves why it has not been adopted in North America. We often tend to be somewhat egocentric in our thinking, but this is a case where we can learn a great deal from our colleagues in Britain.

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ENERGY

The four papers included in this section address our energy problems from four different vantage points. Each author, however, calls for a broadening of our approach to solving these problems. Robert Lewis describes the research program of the U.S. Department of Energy, describes the major factors that set the direction this research takes, and offers several recommendations for improving DOE's research effort. His final recommendation calls for an "increasing focus on total environmental systems and the total process of energy development and use." Kevin Gottlieb discusses the role that coal could play in satisfying our future energy needs and suggests that "it is a national responsibility to measure the true costs of each policy which restrains coal or which compromise environmental quality. A cavalier approach to the variables on either side of the coal-environment equation, serves the nation badly." Judith Schultz reminds us that our energy problems are intimately related to population problems. She notes that "components and implications of population change must remain a critical facet of energy planning." Richard Perrine, *et al.*, focus our attention on the practical difficulties encountered in siting energy facilities. They offer a model representing a systems approach to facility siting and present a case history describing how their system could be used in the siting of a coal gasification plant.

ENVIRONMENTAL RESEARCH PLANS AND PRIORITIES OF THE DEPARTMENT OF ENERGY

Robert A. Lewis¹

Introduction

Being here today is indeed a pleasure. I very much appreciate the opportunity to reach a potentially wide audience through you and thereby to increase public awareness of the problems and opportunities of Federal research on energy and the environment.

As educators, you undoubtedly recognize the importance of your role in bringing issues to the public. It is especially important that you present an unbiased picture of the contributions of energy technology (both positive and negative) to the Nation. The Department of Energy provides only one vehicle for addressing the energy "crisis." An aware and informed public must ultimately set the values to which the programs of the Federal government and the energy industries must respond.

Departmental Organization and Goals

Less than one year ago, the Department of Energy (DOE) came into existence. Until then, Federal energy programs were distributed among numerous agencies having varying charters and legislative mandates. The consolidation of energy functions within a single major department will enable us to develop a coordinated national energy policy that will more effectively and efficiently meet the Nation's needs.

The basic structure,² key responsibilities and tasks of most organizational units of the Department are already well defined. Nevertheless, we may expect to see a continuing refinement and redefinition of priorities and approaches in dealing with the Nation's energy issues. These issues are complex and often so rapidly changing that no one person can hope to adequately comprehend the issues and forces that, in reality, shape the policies, structure and operations of the Department.

The major function of the Department is to enable the Federal government to coordinate its energy research, development, and commercialization activities within a single policy-planning framework that fully recognizes the importance of conservation and near-term resource development. The Department was formed as the most effective means of ensuring that the National Energy Plan is effectively implemented and supported by research, development, and commercialization activities.

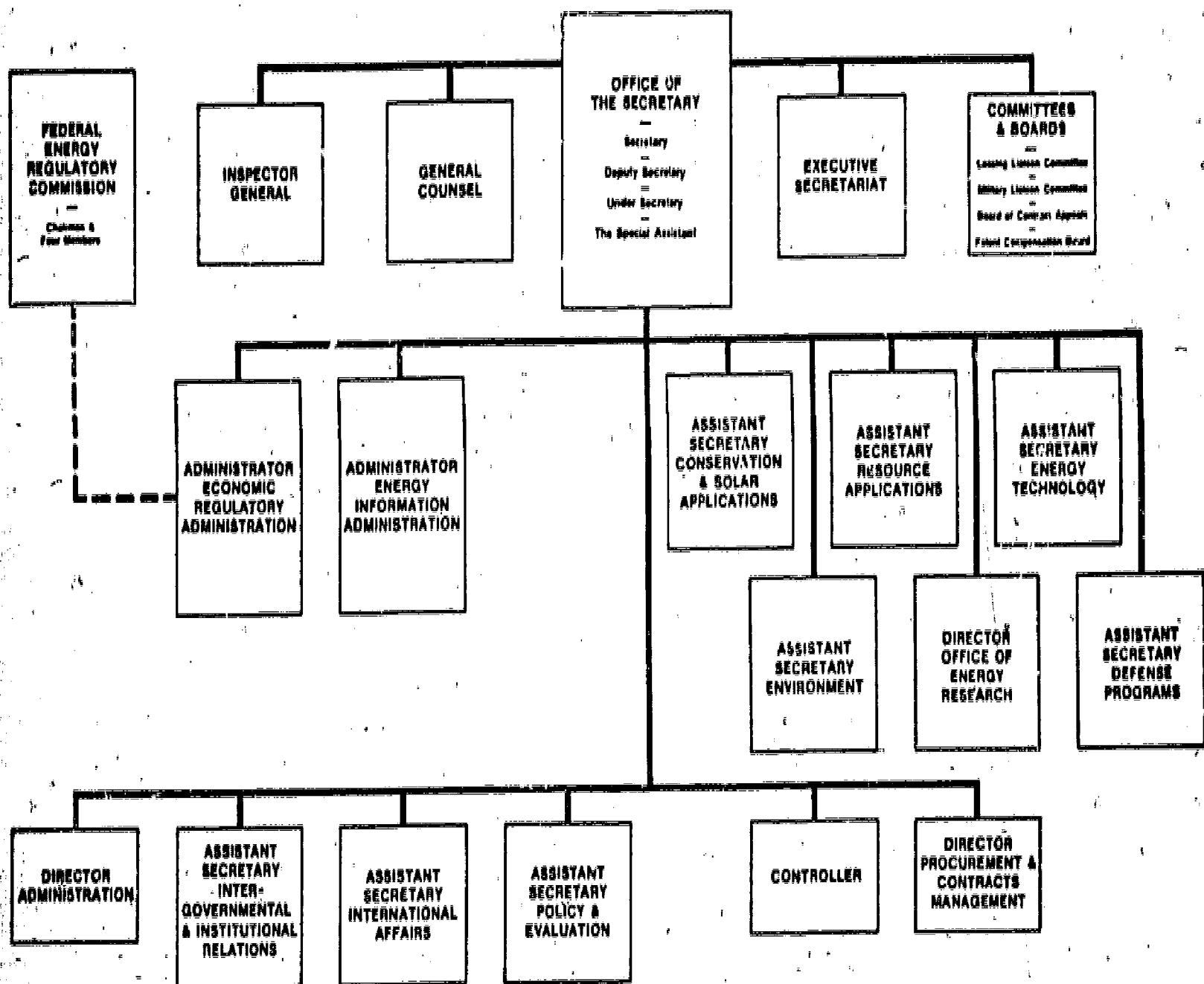
Under the National Energy Plan (which I will soon discuss), the Department's principal goal through 1985 is to reduce the Nation's dependence upon imported oil by increasing the direct utilization of coal by a factor of two, and by stimulating energy conservation. Beyond 1985, the department is to develop and promote the use of alternative energy systems.

The relationships between national energy goals and other national goals (e.g., environmental, economic, social) are complex. All are inextricably interwoven and not entirely compatible. Thus, DOE is only one part of a complex institutionalization of national policy- and decision-making. The role of energy in relation to other national priorities must also be reasonably assessed. Thus, while environmental policy objectives (or economic, or transportation, etc.),

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²See the accompanying organization chart, p. 54.

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may not always be fully consistent with energy policy objectives, they must be identified and communicated to all levels of decision so that priorities can be set on the basis of the best available information and a balanced approach to the attainment of energy goals can be taken. In this process, we should note that energy technologies provide environmental benefits as well as costs.

These goals must be attained with due regard for the Nation's health, safety and environmental well being. In my view, the overall goal is to improve the quality of life in America through the development of environmentally amenable technologies.

The National Energy Plan

DOE's environmental research plans and policies are rooted in the National Energy Plan (NEP). While promoting greater use of coal the President has assured the public that he will also seek to achieve improved environmental quality. Indeed, four of the ten principles upon which the NEP is built relate strongly to maintenance of environmental quality and environmental research. One principle is:

National policies for the protection of the environment must be maintained.

In other words, National energy policy should sustain and improve the quality of life.

In the long run, there is no insurmountable conflict between the twin objectives of meeting national energy needs and protecting the quality of the environment. The energy crisis and environmental pollution both arose from wasteful use of resources and from economic and social policies that were based upon the assumption of essentially unlimited and cheap resources. Solutions to many energy and environmental problems follow a parallel course of improving efficiency and harnessing waste for productive purposes.

Another principle is:

The growth of energy demand must be restrained through conservation and improved energy efficiency.

Energy conservation and improved energy efficiency is considered to be the most effective course of action for our nation and for the world.

Although conservation measures are inexpensive and clean compared with energy production, they do involve sacrifice and are sometimes difficult to implement. Furthermore, it is not possible to establish a priority that any given conservation method is environmentally benign. Therefore, the varied and numerous conservation alternatives must be investigated with respect to health and environmental risks and benefits.

Sacrifices resulting from conservation measures need not result in major changes in the American way of life or in a reduced standard of living. For example, automobile fuel efficiency can be improved through better design of cars, thereby reducing gasoline consumption without altering our ability to travel. Also, with improved energy efficiency, the impact of rising energy prices can be significantly moderated. And energy conservation, properly implemented, is fully compatible with economic growth.

A third principle of consequence to the development of environmental research in DOE is:

Resources in plentiful supply must be used more widely, and the Nation must begin the process of moderating its use of those in short supply.

In order to preserve its scarce reserves of oil and gas and still reduce the growth of imports, the Nation's policies must be geared to reduce consumption of oil and gas, especially by automobiles, industry, and electric utilities. As industry reduces its use of oil and gas, it will have to turn to coal and other fuels. The choices for electric utilities for the foreseeable future will be coal and nuclear power. Expanding future use of coal will depend in large part on the introduction of new technologies that permit it to be burned in an environmentally acceptable manner. We must attempt to perfect processes for the production of synthetic liquid and gaseous fuels from coal.

To the extent that electricity from coal is substituted for oil and gas, the total amounts of energy used in the country will be somewhat larger due to the inherent inefficiency of electricity generation and distribution. But conserving scarce oil and natural gas is more important than saving coal.

The fourth principle is:

The use of nonconventional sources of energy must be vigorously expanded.

Relatively clean and inexhaustible sources of energy may be used as supplements to conventional energy resources in this century, and as major sources of energy in the next. Many of these sources provide inviting alternatives to large, central production systems. Traditional forecasts of energy use assume that nonconventional resources such as solar and geothermal energy will play only a minor role in our energy future. Unless positive and creative actions are taken by government and the private sector, these forecasts will become self-fulfilling prophecies.

In point of fact, nonconventional technologies are not mere curiosities. Steady technological progress is likely, breakthroughs are possible, and the estimated potential of nonconventional energy sources will undoubtedly improve. Because nonconventional energy sources have great promise, the Department of Energy is taking steps to foster and develop them.

Environmental Research in the Department of Energy

A number of DOE offices have environmental research responsibilities. However, the principal responsibilities are assigned to the Office of the Assistant Secretary for Environment (ASEV).

The Assistant Secretary for Environment is responsible for assuring that all Departmental programs are consistent with environmental and safety laws, regulations, and policies. The Assistant Secretary will provide policy guidance for the Secretary to assure compliance with environmental protection laws, and will be responsible for reviewing and approving all environmental impact statements prepared within the Department. In addition, the Assistant Secretary will monitor DOE programs with respect to the health and safety of both workers and the general public.

The Assistant Secretary also conducts environmental and health-related research and development programs, such as studies of energy-related pollutants and their effects on biological systems.

This office also:

- Provides National Environmental Policy Act (NEPA) technical assistance and policy guidance to DOE program and regulatory offices
- Prepares policy and legislative Environmental Impact Statements (EIS's)
- Develops DOE NEPA policies and internal directives
- Reviews and comments upon EIS's from other agencies
- Reviews and assesses environmental, analytical and technical products prepared by other DOE offices

- Reviews and assesses DOE policies and strategies for environmental impacts
- Assures implementation of practical substantive environmental mitigating measures into DOE programs subject to NEPA review
- Acts as link to environmental agencies and environmental community
- Assures adequate health and safety measures in DOE programs
- Provides policy guidance on DOE/Contractor employee health safety measures
- Assures implementation of health and safety measures by DOE contractors

Environmental Research Overview

Energy technology holds one of the keys to our future. It has the power to alter the future today--the power to alter, to preserve, or to dissipate our inheritance. The power to improve or to degrade the world in which our children will live and in which we will grow old and die.

The fundamental aim of technology development goes far beyond purely economic benefits; it is to improve the quality of life. To do so it must not produce health, safety or environmental impacts that negate intended benefits. Similarly, the fundamental aim of environmental science is to improve the quality of life. To do so it must not produce economic, social or political impacts that negate intended benefits.

It is true that certain "technologists" and certain "environmentalists" perceive that their mission of providing the public with something valuable is hampered by the attitudes and activities of the "other side." Such functional polarization is common between people of differing interests and training. In truth, however, the public is best served by optimization of any given technology or set of technologies with respect to the totality of effects on human life and resources.

A primary function of environmental research within DOE is to assure that the emerging technologies are environmentally sound, and to aid in the selection of commercially viable technology options that fit this criterion. The choices are hard and our research, though sometimes lengthy, must be of such quality that our efforts will aid the decision-making process to the benefit of the Nation. We must also seek and use results and advice from a diversity of people and institutions, including colleges and universities, energy producers, and consumers.

Environmental Development Plans

Environmental Development Plans (EDP) are digests of technology-oriented DOE research that identify environmental concerns associated with specific energy technologies. They are intended to provide guidance for the environmental program planning and budgeting process. These documents are used primarily to determine environmental and health research information needs with respect to each technology program, and thereby to provide guidance for the development of energy programs that are fully responsive to technology-specific environmental and health research needs.

Table 1 briefly describes general environmental research concerns. These are further elaborated in each technology-specific EDP.

Current and Near-Term Research

There are ten primary mission areas within DOE. These are:

- Energy Supply - Research and Technology Development (R&TD)
- Energy Supply - Production, Demonstration, and Distribution (PD&D)
- Conservation
- Regulation
- Emergency Preparedness
- Energy Information
- Environment

TABLE 1
Environmental, Health, and Safety Issues and Requirements
for Energy Technologies

ISSUE CATEGORIES	REQUIREMENTS
<u>Air Quality Issues:</u> What constraints should be imposed on the release of effluents into the atmosphere and on the generation of atmospheric physical disturbances to assure that any degradation of air quality from energy operations be held to acceptable levels?	A. <u>Baseline Characterization</u> A.1 Conduct regional preplanning surveys. A.2 Develop operational baseline characterization plans in accordance with regional priorities established by DOE plans for technology operations. A.3 Conduct baseline characterization as jointly recommended by, and with the concurrence of, the cognizant program Division and Offices.
<u>Water Quality Issues:</u> What constraints should be imposed on the release and disposition of effluents from energy operations that may degrade the quality of ground and surface waters?	B. <u>Operational Site Measurements and Monitoring</u> B.1 Conduct analyses of process streams and other operational site sources to assess potential effluents and EH&S impacts. B.2 Monitor the operational performance of environmental control apparatus and procedures. B.3 Assess safety and reliability of potentially hazardous DOE operations. B.4 Assess the adequacy of occupational medical and health surveillance procedures.
<u>Land Disturbance Issues:</u> What constraints should be placed on the development and exploitation of energy to assure that structural changes to the land do not result in unacceptable consequences?	C. <u>Transformation, Transport, and Fate</u> C.1 Characterize chemical and microbiological transformations of effluents from energy technology operations. C.2 Determine the environmental transport mechanisms and fate of effluents from energy technology operations.
<u>Social and Economic Issues:</u> What controls should be imposed on energy development to minimize any deleterious effects on communities involved and to maximize beneficial effects?	D. <u>Effects Studies</u> Determine the effects of effluents and other operational aspects of energy technology operations on: D.1 Ecological systems. D.2 Plants and animals. D.3 The health of the general population. Analyze plans for the development of energy resources and determine the probable effects and consequences on: D.4 Water resources and water use allocations.
<u>System Safety and Occupational Health Issues:</u> What measures should be taken to ensure that the operation of energy facilities adequately provides for the medical and health surveillance and safety of workers?	

TABLE 1 CONTINUED
**Environmental, Health, and Safety Issues and Requirements
 for Energy Technologies**

ISSUE CATEGORIES	REQUIREMENTS
	<p>D.5 Land use allocations. D.6 Social services and community structure.</p>
	<p>E. <u>Integrated Assessment</u> E.1 Develop environmental decision criteria. E.2 Develop consensus standards where official standards do not exist. E.3 Develop continuing appraisals of our knowledge concerning the environmental issues and their resolution.</p>
	<p>F. <u>Measurement and Control Technology</u> F.1 Develop control technologies as needed to meet regulatory standards and environmental design criteria. F.2 Conduct research, development, and assessment as necessary to ensure availability and application of adequate environmental control measures. F.3 Develop improved procedures, models, and systems needed for environmental measurements and monitoring and the simulation of environmental phenomena.</p>

- Basic Sciences
- Atomic Energy Defense Activities
- Policy and Management

At the Department level, current and near-term emphasis will be placed on the application of resources to:

- provide significant increases in conservation, including grants, incentives and technology development;
- continue the purchase and storage of 500 million barrels of oil by the end of 1980 for strategic petroleum reserve and initiate design and construction of storage facilities leading to the President's goal of one billion barrels by 1985;
- recognize the Department's regulatory role in enhancing energy conservation and supply, while providing for a reduction in the administrative burden borne by public and industry;
- continue technology development and commercialization in fossil, solar, geothermal and fusion energy;
- maintain a strong capability for the production and delivery of new and future atomic weapons systems.

Clearly, environmental research and development will be guided by the potential health, safety and environmental risks expected from these activities.

Indeed, current and near-term activities within the environmental mission will focus primarily upon the identification and evaluation of environmental impacts associated with the development of energy supply and conservation technologies. Environmental research activities fall into one of two parallel thrusts, namely:

- overview and assessment to identify and analyze environmental health and safety concerns related to DOE programs and activities;
- biomedical and environmental research to investigate uncertainties and conflicts.

The Department is also involved in the development of environmental control technology. These programs must provide criteria for process development and engineering design selection. However, the development of efficiently designed and engineered control technology options requires long lead times and appropriate information from the environmental research and development programs.

There are four biomedical and environmental research program areas: human health, health studies, environmental studies, and physical and technological studies. Integrated studies of the characterization, measurement and monitoring of energy-related effluents and their effects on health and environment are included.

Human health studies are concerned specifically with the evaluation of the potential deleterious effects on human health of exposure to chemical, physical and biological agents associated with energy production. Because many human health impacts of energy are common to alternative technologies, methods of early diagnosis and treatment of human health effects related to the various technologies are being developed.

Health effects research is primarily concerned with extrapolation to man of results of studies of the effects of pollutants on experimental animals. Molecular and cellular studies provide the basic understanding that is necessary to perfect our ability to predict human health risks. This work is aimed at the prevention of human illness through early definition of risk.

Environmental studies provide information needed: (1) for environmental policy analysis and decisions related to future energy-environmental conflicts and choices; (2) to assess the effects of energy technologies on the environment, including the transport and the effects of pollutants and physical disruptions

from energy extraction, conversion, and end use; (3) for positive environmental action such as the mitigation of adverse effects, and the use of environmental understanding to increase the availability of energy; (4) to develop biological systems for use as energy resources; and (5) to describe environmental interactions of pollutants.

Physical and technological programs characterize the full range of potentially adverse elemental inorganic, organic and radioactive species present in liquid and gaseous effluents, products, solid wastes and fugitive emissions. Research into advanced measurement concepts and systems, including development of improved measurement and monitoring instrumentation is also conducted by this program. Also included are studies of the physical and chemical interactions of pollutants in the environment as well as radiation interaction with biological systems.

Life Sciences Research and Biomedical Applications which form part of the Basic Sciences Mission include several activities:

- Research in general life sciences for better understanding of the risk to human health from energy-related pollutants.
- Facilitating the transfer of nuclear technology to medicine.
- Development of advanced diagnostic and therapeutic methodologies for the medical community.

Research in the general life sciences is aimed at the mechanistic and conceptual bases for understanding the interaction of energy-related pollutants with biological systems. These studies develop the knowledge needed to design rapid and sensitive tests for biological damage, determine how the gene expression of cells is altered to provide mechanistic explanations of pollutant carcinogenesis and mutagenesis, determine through biophysical and biochemical approaches the cellular mechanisms for pathologies related to pollutant exposure, and develop a fundamental understanding of comparative cellular and molecular processes to reduce the uncertainty in extrapolating risk estimates from studies in animals to human populations.

Areas of new research emphasis include conservation, alternative fuels and other supply initiatives, the characterization of impacts of industrial coal use, enhanced oil recovery, water pollutant impacts of oil shale development, coal mining geopressured methane, and industrial and municipal waste fuels.

Near-term major emphasis in the nuclear area will be placed on health effects of low-level radiation and on light water reactor safety, since from the environmental standpoint an improved understanding of both "items" is crucial to decisions regarding the future of the nuclear industry.

There are a number of research areas (such as the health and environmental effects of SO_2) that are of joint concern to DOE, EPA and other agencies. In such areas improved interagency cooperation is desirable. DOE is working to that end and a number of cooperative research programs are being conducted.

The U.S. Climate Program is an example of comprehensive interagency planning and cooperation. This program is intended to help the Nation to respond more effectively to climate-induced problems. Research will be conducted to improve methods to predict climatic fluctuations and their domestic, national security, and international impacts and to identify man's impact and potential influence on regional and global climate.

Another interagency program of potentially major consequence is about to be launched to study the global consequences of increasing concentrations of atmospheric carbon dioxide. DOE is the lead agency.

Research will initially be organized primarily about two major questions:

- 1) What will be the future atmospheric concentrations of CO_2 ?

2) What will be the climatic effect of these concentrations?

Clearly, long range research is implied by the complexities reflected in these broad questions. Nevertheless three additional concerns will also be addressed soon:

- 1) What will be the effect on the biological and physical environment of these climate changes coupled with increased CO₂?
- 2) What, if any, will be the effects of these changes on human societies?
- 3) If these changes are undesirable, what actions can be taken to prevent them?

Ultimately, investigation of practicable ways of reducing the CO₂ content of the air, either by direct removal from the air or by "scrubbing" the effluent of power plants, should be investigated.

Future Research

Federal research is being reshaped in ways and by forces that no one individual can fully understand or predict. Thus, what I say here is speculative, resting mainly upon historical analysis and the projection of perceived trends and the current thinking of colleagues and National leaders.

The prediction of future research orientation and priorities of the Department of Energy is nevertheless aided by the inertia that is provided by the present organization, activities, and policies of the Department as well as the various legislative acts and the regulations to which the Department must respond.

The National Energy Plan and the pending National Energy Act will strongly influence future research within the Department. By 1985, national goals as now perceived are to develop and promote the market penetration of alternative energy systems such as dispersed solar systems, geothermal systems and combustible waste systems. A combination of nuclear, fossil fuel systems, solar electric and geothermal central stations are to be developed.

Substantial health and environment research will be required to support these goals. We will become increasingly concerned with the health and environmental effects of chronic exposure to a large array of manmade chemicals, only some of which will originate from energy systems.

In response to the President's Energy Message, earlier this year, a panel of experts on environmental science and human health was assembled to evaluate the impact of increased coal combustion by analysing a set of specially prepared reports. This review was followed by public hearings to assure that a wide range of knowledge, opinion and interests were considered. The panel concluded that the National Energy Plan would probably not produce adverse health and environmental impacts. However, several areas of uncertainty were identified. The major areas requiring further research included:

- air pollution health effects;
- coal mine worker health and safety;
- global effects of CO₂;
- acid fallout;
- trace elements;
- reclamation.

With respect to DOE actions, major environmental research will continue to center about fossil fuel combustion for several decades.

Dr. James L. Liverman, DOE's Acting Assistant Secretary for Environment, concluded the following in a recent address:

Based upon DOE assessments, "The environmental impact of the additional use of coal under the National Energy Plan in terms of residuals is seen in all processes of the coal fuel cycle from extraction, to combustion, to waste management. ... there are air pollution increases due to combustion levels but other forms of residuals and use of scarce resources are also up -- dissolved solids in water, industrial sludges, mining wastes, ashes, water use, and land for mining. ..."

..."We found that while there are new technologies for burning or converting coal such as gasification, liquefaction and fluidized bed boilers, even in the year 2000 these will not have made major commercial penetration on a national basis as compared to conventional coal-burning boilers. Therefore, in most regions, the primary air pollution impacts are due to growth in coal boilers, especially industrial boilers. Predictably, two areas of the country fall out with potentially serious sulphur oxide problems: the industrial northeast and the crescent of states surrounding this northeast area..

In the northeast, there are presently eight states that emit at least one million tons of sulphur oxides each year. Increasing coal use in an area that already uses a lot of coal, with the addition of increasingly stringent environmental control devices, keep sulphur oxide residuals at essentially the same levels that now exist. However, sulphur emissions in this multistate area are presently believed to cause unacceptable environmental damage, both in their local area and in the states downwind. Thus, present problems may continue on a long term basis unless new controls are found."

Technology development and commercialization activities will continue to shape research within DOE. Indeed, it is recognized at all levels of government, that the environmental impacts of energy-producing technologies represent significant costs to society. And environmental, health and safety concerns must be incorporated into energy planning, technology development and policy analysis.

To be effective, the technology-specific environmental research must be coordinated with the engineering design and development process. Such research should be more sharply focused in the future and should shape and be shaped by 1) the features and priorities of the technology and 2) energy-environmental policy analysis.

The importance of environmental research in predicting and in mitigating constraints on commercialization of new and advanced technologies will rapidly increase during the coming decade.

The general objective of Federal commercialization actions is to achieve the maximum rate of market penetration of the best technologies while minimizing the potential socio-political impacts of the systems.

Government actions in the form of accelerated commercialization policy and planning are about to begin. It is absolutely essential that the appropriate environmental research planning and implementation proceed concurrently.

In terms of the present discussion, we should note that Federal involvement in the commercialization of new energy technologies is aimed at achieving two major policy objectives. These are the provisions of renewable and other resources to meet U. S. energy needs in the next century and reduction of reliance on scarce and non-renewable resources. These commercialization activities must support a healthy and growing economy and protect and enhance environmental quality.

It is easier to identify major factors that will drive or condition energy-related environmental research during the coming decades than it is to predict the actual research trends.

Major forces that guide research include the following:

1. Federal legislation
 - a. National Energy Act (pending)
 - b. National Environmental Policy Act
 - c. Energy Reorganization Act
 - d. Resource Conservation and Recovery Act
 - e. Clean Air Act
 - f. Federal Water Pollution Control Act
 - g. Endangered Species Act
2. Regulations and standards promulgated by various agencies in response to these acts.
3. State and local policies, laws and regulations.
4. Public awareness and response to actions arising from DOE programs.
5. The specific technologies that are selected for early commercialization. These will almost undoubtedly include one or more synthetic fuel technologies and one or more conservation technologies.

I recommend for the future:

1. Increased emphasis on basic and generic (or process-related) research.
2. More research in support of regional analysis.
3. Use of operations research methods (i.e., decision analysis) to optimize total energy systems on regional, national and global scales.
4. Recruitment of effective social sciences research, especially research dealing with social perceptions of energy-environmental strategies and developments and studies of demographic and secondary impacts of energy systems.
5. Recruitment by DOE of the widest possible range of talent and expertise. More basic research should be sponsored and a research climate that promotes innovation should be sought.
6. Increased research upon effects of chronic exposure of living systems to complex arrays of pollutants.
7. Increasing focus on total environmental systems and the total process of energy development and use.

I will gladly answer your questions or provide you with appropriate references or contacts.

THE NATIONAL ENERGY POLICY: AN EXAMINATION OF COAL CONVERSION LEGISLATION

Kevin C. Gottlieb¹

The world's oil and gas reserves will meet consumers' needs for approximately thirty more years, given the present rate of consumption. Alternate sources will not be available, in large quantities, for many years. Consequently, more time is required to explore alternative energy paths. With the appropriate use of coal, the nation can purchase the required time.

Coal represents 90 percent of the Nation's total fossil fuel reserves. Yet, it currently supplies only 18 percent of the country's energy needs. The Carter Administration's National Energy Plan was designed to increase the appeal of coal as the principal alternative for meeting the Nation's energy needs in the short term. In the National Energy Plan, the Administration expects annual coal production to reach 1.2 billion tons by 1985. This represents an increase from the 665 million tons produced in 1976. Several of the proposals in the energy plan require the substitution of coal for oil and natural gas in industrial and public utility use. In fact, more than half of the President's anticipated savings in imported oil by 1985 would result from coal conversion; that is, the conversion of electric power plants and major fuel burning installations from oil and gas to coal.

To further increase the use of coal, environmental groups, industry and government, working together, must develop new methods of gasifying and liquefying coal into efficient energy, with a minimum of environmental side effects. Coal has not been as attractive as oil and gas for a number of reasons, particularly the uncertainty of Federal environmental standards. In order to render coal more useful to the society and less harmful to the environment, the Carter Administration proposed a four-dimensional approach to the problem:

1. a regulatory program to require coal use by utilities and large industries;
2. an oil and gas users tax and rebate/investment tax credit system to provide economic incentives to convert to coal;
3. an environmental policy for using coal to minimize risks to public health and environmental damage; and
4. a research program for coal conversion, mining and pollution control technology.

Notwithstanding President Carter's good intentions, the National Energy Plan, currently emerging from Congress, is more a national tragedy than the moral equivalent to war it was intended to be. The newly created Department of Energy is desperately trying to determine the functional differences between the many agencies it inherited at the time of its creation. The Congress, already overburdened with an abundance of tasks and a shortage of skills, staggers under the added weight of the energy proposals coming forth from the Executive Branch. Confusion, frustration and fatigue reign supreme.

Outside the confines of Washington, the general public has long since disabused themselves of interest in the Washington energy deliberations. Senators and Congressmen, returning to their home states, find interest in energy questions diminished, if not altogether absent. This public disengagement is perhaps a testimony to a curious blend of national success and failure. While the Nation has increased the amount of imported energy, it

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has also succeeded in delivering large amounts of Alaskan oil, testing severely the credibility of anyone who contends there is an American energy problem. But at the same time, the Nation has failed to produce more than a modest energy price squeeze while energy availability is seldom doubted even after a three-month coal strike during one of the Nation's coldest winters.

Some will be inclined to say that the aforementioned muddling through is proof that the American system works. Some will be inclined to say that regardless of the defects in the private and public sectors, those sectors always prevail, however imperfectly, in the end. I can not be one of those who says the system works, unless of course I were to add that the system works in spite of itself.

The most frustrating example of imperfection in the current energy debate is perhaps the handling of the issue of coal conversion. The debate over coal conversion covered an issue which is the linchpin of the entire national energy policy. That is, the conversion of industrial and utility fuels from oil and natural gas to coal. Without this conversion, the remainder of the national energy deliberations are meaningless. Without this conversion and the concomitant savings of oil and natural gas, the conventional American standard of living might soon be impossible. A brief look at this issue serves to illuminate the larger problems facing the nation in developing a cohesive national energy policy.

On Friday, November 11, 1977, Senate and House conferees completed action on legislation to foster greater utilization of coal and other fuels to replace natural gas and petroleum. The original Senate measure, entitled "The Natural Gas and Petroleum Conservation and Coal Utilization Policy Act of 1977," was reported on July 25, 1977, by the Committee on Energy and Natural Resources. That bill passed the Senate on September 8, 1977, by a vote of 74 to 8. The comparable House provision was Part F of the National Energy Act, which passed the House on August 5, 1977.

The objective of this legislation is to encourage greater national energy self-sufficiency by mandating that specific categories of new and existing electric power plants and major fuel burning installations, including Federal facilities, must use indigenous coal and other fuel resources in place of natural gas or petroleum. The intention of the act is that this substitution of coal for oil and natural gas must be achieved in a manner consistent with applicable environmental requirements. To supervise this substitution process, the authorities for substitution are vested in the Secretary of Energy, James Schlesinger, with very few exceptions.

At the outset of this discussion, it is important to keep in mind that there are two major categories in the coal conversion legislation. Category number one is electric power plants. Category two is major fuel burning installations. Each of these categories is separated into two parts: new plants and existing plants. For the purpose of definition, a new electric power plant is a boiler, gas turbine or combined cycle unit, that produces electricity for sale or exchange. It must be a unit that, by design, is capable of a fuel heat input rate of 100 million BTU's per hour, or be an aggregate of units which together are capable of a fuel heat input rate of 250 million BTU's per hour. A new electric power plant is defined as one for which, as of April 20, 1977, substantial on-site construction or replacement had not commenced.

Within this category of new electric power plants, the principle of coal conversion is simple. If the plant is in this category, then it must be constructed only for coal; it must burn only coal as its energy source for the future. While that principle may seem quite direct and simple, it is mitigated by a substantial number of exemptions, and in these exemptions one can find the major weakness of the national energy policy. Exemptions from the order to convert to coal may be sought and granted by the Secretary of Energy, prior to the effective date for new electric power plants. While

exemptions as a category are totally proper, the extent of the exemptions provided under this bill, and the number of exemptions provided, serve to reduce, fundamentally, the possibility of achieving the stated goal of the bill. That is, the savings of oil and natural gas will not occur without the conversions. Without the conversions, our reliance upon foreign energy sources will continue.

Under the statutory prohibitions section of the bill, new electric power plants are prohibited from being constructed with the capability to use natural gas or petroleum as their primary energy source. But, the exclusions from these prohibitions are so substantial as to render the coal conversion policy considerably less effective. For example, excluded from the definition are:

1. commercially unmarketable quantities of petroleum and natural gas;
2. natural gas from wells producing less than 250 million BTU's per day;
3. certain mixtures of natural gas and synthetic gas where owned by a user; and
4. synthetic gas from coal, which is not mixed with natural gas.

At first examination, these exemptions seem reasonable, but when one considers the inevitable move toward synthetic natural gas (from coal) in the future, the necessity for that gas will be as a substitute for petroleum and natural gas presently in use in temperature-sensitive processes. If that gas is permitted for use in new electric power plants, it removes synthetic gas from availability as a potential substitute in more sophisticated industrial processes.

There is another category in the bill which provides for temporary exemptions. All temporary exemptions for new power plants, except where noted, are conditioned on a "reliability test." That reliability test must indicate that no adequate alternative supply of electric power is available on a short or long term basis at a reasonable price and distance without impairing the power systems' reliability. The problem with temporary exemptions of this variety is that these kinds of tests are susceptible to extensive maneuvering by special interests. This manipulation serves provincial interests while it disadvantages the Nation's interests.

General temporary exemptions are to be granted where:

1. there is an inability to comply with applicable Federal and state environmental requirements;
2. there exists site limitations such as inadequate coal transportation or storage facilities; and
3. the exemption would further the purposes of the act and be in the public interest.

While these dispensations alone might not seem prohibitive, when they are viewed in conjunction with the other exemptions they comprise a fundamental weakening of the coal conversion act. For example, temporary exemptions to permit the use of natural gas and petroleum may be granted if synthetic fuels derived from coal or some other fuel will be employed by the new electric power plant. This exemption would permit the plants to use these synthetic fuels for an additional five years. Moreover, this exemption would not be subject to the reliability test. Consequently, it would be possible for valuable synthetic fuels to be used for electric power plants rather than

for easing the pressure on natural gas in other dimensions throughout the society.

As one examines the coal conversion act, it is ironic that so much of the act is devoted to the exemptions from the act. The principle of coal conversion itself may be simple and direct; the exemptions are extremely complex and extensive. The explanation for this is quite obvious: individual firms lobby for their interests.

An additional category is devoted to permanent exemptions. General permanent exemptions are to be granted for the same reasons which support general temporary exemptions:

1. where there is an inability to comply with applicable Federal and state environmental requirements;
2. where there are site limitations; and
3. where the exemption would further the purposes of the act and be in the public interest.

While these are justifiable reasons for providing exemptions, one might contend that these exemptions ought not be permanent and that under changed circumstances, the exemptions might be lifted, for example, if new technology enabled the plant to meet Federal and state environmental requirements while using coal.

Another interesting aspect of the bill provides permanent exemptions to new electric power plants, where necessary, to prevent impairment of reliability of service. The problem here again is that the test for determining impairment of reliability of service is sufficiently subjective as to permit individual plants a convenient opportunity to avoid converting to coal.

The preceding statements which have been made about new electric power plants also apply to new major fuel burning installations. In almost every case, the same exemptions apply and the same conditions apply. Consequently, similar limits on the amount of coal conversion and, therefore, energy savings, are present when discussing major fuel burning installations.

One interesting example affecting the case of a new major fuel burning installation deals with installations between 100 and 300 million BTU's per hour. In these cases, the Secretary may grant a temporary exemption for these installations to use petroleum when there are contractual agreements or other evidence of the firms' plans to utilize coal or other fuels following the exemption. With a provision of this nature, most units may try to obtain temporary exemptions to buy time and to avoid the cost of conversion. More harmful than this exemption, however, is the exemption which provides a permanent grant to use natural gas or petroleum where satisfactory control of product quality or process requirements cannot be met with the use of coal or other fuels. In some industrial cases, this is justified. There are some production processes which are so temperature sensitive, they cannot use coal. However, in other cases, this exemption would be used as a method to avoid compliance or to avoid the development of new industrial techniques susceptible to using coal.

Up to this point in the discussion, the examination of coal conversion has centered on new facilities. An area of at least similar if not greater importance deals with existing electric power plants and existing major fuel burning installations. Under previous prohibition orders issued by the Federal government, a number of electric power plants and major fuel burning installations have refused to convert, choosing instead to fight the Federal government's action in the courts. Another unfortunate aspect of the current coal conversion bill is that it permits existing electric power plants, which have been issued previous prohibition orders, to continue to be subject to

those orders rather than to be subject to the new legislation. These previous orders are still being fought in the courts because the firms consider it more cost effective to take legal action than to expend the capital for conversion.

With regard to existing electric power plants, these plants are prohibited from using natural gas after July 1, 1990. However, twelve years of natural gas consumption at the current growth rate will exhaust a great deal of the natural gas supply. To permit a date as flexible as this one is to encourage substantial consumption of natural gas at a time when we are trying to make more efficient use of that gas. Moreover, postponements of the prohibition may be obtained following 1990. These extensions promise to deplete our natural gas reserves even further.

A very important dimension of the coal conversion program is the requirement which limits conversion to plants which are already "coal capable." Each existing electric power plant identified in the rule under this act must be found to be technically and financially capable to consume coal or other fuels without substantial physical modification or downgrading in rated capacity. Again, while this exemption is understandable on the surface, when examined further it reveals a systematic problem with the Nation's attitude toward coal conversion. Technical and financial sacrifices are the kinds of sacrifices which must be made if the Nation is to alter its present energy direction. If the Nation intends to design a coal conversion process which is painless, it is doomed to fail. The only valid question at this juncture is how severe the sacrifice should be and how it should be passed along to industry and the consumer. If the Nation attempts to minimize the sacrifice, it compromises the achievements of the legislation. For example, a temporary exemption from the order to convert to coal is to be granted for those power plants that are retiring their existing electric capability. But how long will the retirement require? We cannot pursue a course as a Nation which allows a protracted use of oil and natural gas in order to reduce the amount of sacrifice individual firms will have to absorb. Another exemption is available if the existing electric power plants would incur substantial financial penalties because they cannot terminate an existing contract. The apparent reasonability of this exemption pales when one considers that it is far more judicious to legislate the reduction of the financial penalties than to permit exemptions from the order to convert to coal. The unequivocal fact here is that fossil fuel resources are depletable. Financial payments have considerably more flexibility than do finite fossil fuel resources. Therefore, coal conversion should take priority over financial penalties which could be mitigated by Federal action.

One of the major areas of concern at the Federal level has been how to convert existing electric power plants to coal while maintaining reasonable environmental standards. Under this act, loans are authorized for existing electric power plants to finance up to 75 percent of the cost of air pollution control equipment certified by the Environmental Protection Agency as necessary in order to use coal. With a provision of this sort, financing of the appropriate environmental safeguards should not be a major problem.

One of the more perplexing aspects of this particular coal conversion policy is that the burden of proof for determining a plant's coal capability is placed on the Secretary of Energy. This is a very important and potentially harmful provision in the legislation. The Department of Energy must assume the cost in terms of money and time, if they are to require an existing power plant or major fuel burning installation to convert. Almost certainly, this provision will mean substantial court action by individual plants and substantial delay in order to follow the court actions through to their conclusion. These kinds of delays have been prohibitive in the past and have been pursued by individual plants and companies as a means of postponing the eventual conversion.

One of the most disappointing aspects of the policy is that it is insufficiently coercive. The mandatory, coercive dimensions are generally

inadequate throughout our entire national energy policy but in the coal conversion bill this weakness is particularly evident. The obvious explanation for this is that under a democratic, free-enterprise system, every possible effort is expended to encourage voluntary compliance with regulations. Unfortunately, this procedure has been seriously deficient in recent years. Moreover, the time available for reducing the national consumption of oil and natural gas is fast disappearing. Even the penalties under this act are of a questionable severity. Before criminal penalties may be assessed against corporate officers, the Secretary of Energy must establish knowledge of receipt of notice of noncompliance. Civil penalties are up to \$25,000 for each day of violation. Criminal penalties are up to \$50,000 for each day of violation or imprisonment for not more than one year for willful violations. As stringent as these penalties may sound, one wonders whether or not they are vigorous enough to deter continued use of oil and natural gas. It may be that individual firms may be willing to incur penalties, as long as their profits are substantially high enough to warrant absorbing the penalty for a fixed period of time.

The primary objective of the Carter Administration's coal conversion program was to save an estimated 3.3 million barrels of oil per day by 1985. That estimate was reduced to 2.3 million barrels in the Senate coal conversion bill. The final bill with all its compromises described here has emerged from the House-Senate conference and promises to conserve an even smaller amount of oil and natural gas. Clearly, these compromises have seriously reduced the effectiveness of the legislation and the President's plan.

Some may be tempted to suggest that by reducing the Nation's coal usage, one is increasing the quality of the country's environment. Such simplistic reasoning fails to consider the sophistication of current pollution control equipment. Moreover, it fails to account for the coal cleaning processes already in existence. It is safe to predict that, in the future, technological development will include improved equipment and methods for mining, transporting, processing, and burning coal.

The recent National Coal Policy Project, under the sponsorship of the Georgetown University Center for Strategic and International Studies, heralds a new era for coal usage in the United States. This project assembled leading individuals from industry and from environmental organizations in an effort to reach a consensus regarding the use of coal in an environmentally acceptable manner. While the Project did not achieve total agreement on all major environmental policy issues, general agreement was reached on five topics with substantial significance for environmentalists. The Project concluded:

1. that mining should be discouraged in areas where solutions to the environmental problems have not been demonstrated, with the result that the Nation would look primarily to the Illinois Basin and Southern Appalachia for coal, along with emphasis on deep mining;
2. that major coal-burning facilities should be located in the general area of the ultimate energy consumers;
3. that an emission charge and rebate plan should be instituted to provide a strong economic incentive to invest in more efficient pollution abatement technology;
4. that a consolidated early hearing should be held on approval procedures at the state level for siting energy facilities in order to expedite issuance of necessary permits; and there should be public funding for citizen groups in such proceedings; and

5. that increased efforts are needed to protect archaeological values from destruction by surface mining, to reduce the environmental impacts of underground mining, and to restore all farmlands in the midwest to prior levels of productivity; that mining permits should be issued on a watershed basis to control watershed impacts.

The growing urgency of our national energy dilemma is changing the ideological boundaries of the Nation's energy and environmental factions. As the National Coal Policy Project illustrates, environmental groups and industry representatives are beginning to realize that the goals of energy supply and energy conservation are not mutually exclusive. Nor are these goals separate from the concern for maintaining a satisfying environment.

As one examines the first National Energy Plan, it is clear that the Plan will not succeed in adequately reducing the demand for energy. As the discussion of coal conversion presented here indicates, the National Energy Plan is riddled with compromises which simply are too generous.

The first installment of President Carter's Phase Two Energy Plan is expected to reach Congress this week. Unlike the original plan which emphasized conservation, Phase Two is oriented toward boosting supply. Throughout the past year, while the Phase One conservation measures were being discussed in Congress, representatives from the energy production and distribution groups worked to discourage aggressive conservation policies. Now, with the Phase Two energy supply initiatives coming to the Hill, environmental groups are gearing up to lobby against increased supply policies. Working at cross-purposes in this manner can only harm the national interest. Constraining coal to maintain environmental quality is appropriate. But the constraints must be calculated with a careful cost-benefit analysis. It is a national responsibility to measure the true costs of each policy which restrains coal or which compromises environmental quality. A cavalier approach to the variables on either side of the coal-environment equation serves the nation badly.

The key in the months and years ahead will be restraint. If the Carter Administration will propose feasible coal development policies, after seeking the advice of industrial and environmental groups, and if the Congress will support these policies with reasonable controls for environmental side effects, then the United States may resolve its energy dilemma. Failure to exercise appropriate restraint will encourage further excesses by the various factions. One respected research effort has even noted the possibility of these excesses leading to a civil war throughout the Nation.² If the President's exhortation to the "moral equivalent of war" degenerates into a civil war, it will be a war about which nothing moral will be said.

²Gerald Decker, Willem Veddar, Richard H. Demmy, Forest Beckett, "The Hard Truth About Coal, Conservation, and Our Energy Problem," Open Letter to Congress, April 18, 1977.

THE ENERGY MISSING LINK

Judith M. Schultz¹

No single environmental problem recently has captured more active discussion and debate than the energy crisis. Most importantly, a credibility gap concerning the reality and severity of the long-range crisis has arisen among the citizenry as a result of the conditions surrounding the Arab Oil Embargo of 1973. However, even current discussions of the long-range crisis and proposed solutions by experts have often neglected a critical component as a major link in energy planning. Demographic considerations and implications of population change have not been consistently used in energy planning. These components are vital to any viable long-range approach dealing with the energy crisis. A systems approach, which includes these components among many others, must be used if reasonable solutions are to be designed.

In 1962, geologist King Hubbert provided a report to the Committee on Natural Resources of the National Academy of Sciences documenting the end of the fossil fuel era based upon inventories prepared as early as the 1940's and 1960's by the American Gas Association and the American Petroleum Council, as well as by the National Petroleum Council and the U.S. Geological Survey. Estimates made by the U.S. Geological Survey in 1973 did include for the first time an isolated demographic consideration which shifted the percentages of remaining fuel downward based upon changes in per capita consumption. However, projections of energy consumption based upon per capita change typically have not included a thorough examination of demographic trends, nor the potential alternatives for per capita energy conservation.

Rather, the industrial world has utilized projections of increased energy consumption based upon simple extrapolation of recent usage in order to promote increased exploration and subsequent extraction of energy resources. This fact remains true even though there is growing consensus among international experts that the most significant fossil fuel energy sources are now known and have been quantified. No major "hidden energy paradigm" will be expected to be discovered beneath the sea or in some remote niche of the earth. Since resources are finite, it then follows that as population increases, regardless of per capita consumption trends, the ratio of resources to individuals must eventually fall to an unacceptable level. This axiom brings to mind the so-called "Malthusian dilemma." While Malthus originally considered food the limiting factor of subsistence, energy availability can be envisioned in a similar way, as fuel is ultimately a form of stored energy.

Malthus' approach was that of a synthesizer of thoughts received from predecessors. At the heart of Malthus' synthesis are two propositions applicable to our present energy planning: 1) Population is necessarily limited by the means of subsistence; and 2) Population invariably increases where the means of subsistence increases unless prevented by some powerful and obvious checks. Though a shrewd analyst, Malthus was unable to foresee the effects of recent change since his lifetime spanned the pre-industrial era. The technological era which followed his death ushered in important changes such as birth control and improved farming methods which, at least for a time being, tended to undercut the pessimistic conclusions which logically extend from Malthus' analysis. However, Malthusian theory has been revived in recent years and appears to have application to the current energy crisis.

Population growth accelerates extraction and resource use and intensifies scarcity. Scarcity of fossil fuel is caused, in addition, by economic realities, political ideologies, and social and psychological forces. Energy problems associated with human population growth result from exponential increase (births-

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deaths) and immigration, and from problems of population distribution (i.e., concentration of populations in specific geographic locations incurring energy losses transporting fuels distances from the source of extraction and processing).

Past and present trends of population growth complicate resource planning. In fact, while one aspect of the energy crisis is the difficulty in securing the latest technically accurate geological information on proven, probable, and possible reserves of fossil fuels and isolated small new discoveries, it turns out that this data may be the single most reliable kind of information currently available for long-range energy planning. Disparate short term trends in population growth complicate usage of demographic components in energy planning. Nevertheless, this component must be given due emphasis. Examples of such trends include the lowering of the fertility rate during the depression years of the thirties. At that time, many individuals were proposing that U.S. population would self-stabilize by 1940, followed by a severe decrease in population growth. These same individuals urged Americans to have larger families (Charles, 1935; Spengler, 1930). Yet, this brief trend and associated forecasts were followed by the post World War II baby boom of the late forties through the early sixties. Once the post war families were established, a "birth dearth" of the early seventies was publicized by the press. The prospect of an "echo boom" commencing in the late seventies may become a reality, as the post World War II "baby boom" generation that temporarily postponed having children longer than any other similar age cohort historically in the United States, begins establishing its own families. Each of these trends has occurred and resulted in population shifts within an approximately twenty-year reproductive generation which would have provided useful input into resource planning. A stabilized population, or zero population growth, which now occurs in several European nations, would, of course, produce the most useful demographic data for such planning.

To date, none of the aforementioned population trends have been incorporated into resource planning by policy-makers. Obviously, planned demographic trends, at least in the broad spectrum of positive, negative, or zero growth, would place the planner and policy-maker "ahead of the game" so to speak, rather than in a position of following up on trends which had already commenced. Given the absence of such "designed trends," or influences upon the population, even the short-term trends can be better predicted if an understanding of animal population dynamics were more widely understood. Only then could demographic components be more highly utilized in energy planning.

One debate which continues wherever human implications are involved is whether or not animal research data can be extrapolated to humans. No matter on which side of the debate researchers find themselves, the best available research data must be utilized in lieu of human research, or we reverse ourselves to the Dark Ages of the pre-scientific era. Thus, there are a number of valuable concepts which may be gleaned from animal population data which might then be utilized for demographic projections for resource planning.

The majority of plant and animal species of the world have been found to have population regulatory mechanisms which upon investigation respond to environmental stress. Thus, one might extrapolate such mechanisms to our own species. Boughey (1973) notes that it is sometimes maintained that our species is too recent to have evolved evolutionary mechanisms for regulating population. Apparently, it is at least as old as the Pleistocene Age (Martin, 1967), and contemporary with the majority of plants and animals.

In the past, starvation and disease were density-dependent, extrinsic and intrinsic factors contributing to the regulatory mechanisms in humans and other animals. Such extrinsic and intrinsic factors similarly affect other animal populations such as have been shown in classical studies of the snowshoe hare and lynx (MacLulich, 1937), and Tasmanian sheep (Davidson, 1938). Population growth trends in Tasmanian sheep illustrate a type of animal population growth known as logistic growth. The phrases "a good year for rabbits" or "a bad year for mosquitos" exemplify the subtle logistic population cycle containing hills and

valleys which occur in certain animal populations. Logistic growth is comprised of a lag phase or slow initial growth (due to the reaching of sexual maturity, finding of mates, and gestation periods), followed by an exponential growth phase, and a gradual tapering off of growth. The Norway lemmings of Scandinavia, as well as the collared lemmings of North America, and the seventeen-year locust exhibit irruptive growth trends in contrast. Irruptive growth is interrupted by sudden, usually catastrophic crashes of viability as depletion of resources and food and environmental contamination occur. This latter approach has also been called "the population crash curve," or "letting nature take its own course." During devastating kill-offs of animals species undergoing this type of growth, the carrying capacity is "overshot." Tidal waves, epidemics, and massive crop failures could be conceived of as parallel experiences by the human species.

One problem does exist with using components of population dynamics for energy planning. Population studies both in non-human and in human species have thus far involved discrete geographic areas of animal preserves, islands, nations, or isolated subpopulations and ecosystems. In reality, the human population projections which are now needed for energy planning require interactions of population with an entire planet, rather than with a discrete geographic area.

If extensions of animal growth patterns can be made to the global scale of the population/energy interface, irruptive, or logistic growth patterns still may be conceivable. In a scenario of irruptive growth, humans could be envisioned in the midst of an exponential growth phase of the curve (lag phase having occurred for all of human history prior to 1650, which is considered the beginning of the population explosion). The human brain and opposable thumb may have provided the technology for the manipulation of environment so as to delay the appearance of "the crash." As population continues its doublings, it could "overshoot" carrying capacity at any time. Crisis upon crisis (such as the energy crisis) would suddenly become unsolvable in this scenario of a complicated technological world, and could soon lead to rapid population decline, associated with simultaneous increase in rate of extinction of other species of plants and animals cohabiting the planet with humans. Removal of species from levels within food webs would further increase instability of ecosystems. Such precipitous declines would undoubtedly lead into a new "dark age" of the twenty-first century.

In contrast to the pessimistic irruptive human growth scenario, the logistic approach could be a gradual approach to world zero population growth or stabilization, by conscious intervention to reduce world fertility to replacement level. (It should be clarified that reaching replacement level -- an average of 2.1 children per family -- does not equate to stabilization, but can produce stabilization over a long period of time. For example, in recent years the United States reached replacement level and is now far below it at 1.8 total fertility rate, yet the nation continues to have a natural increase (births-deaths) of 1.2 million individuals annually.) Boughey (1973) suggests that the possibility exists that our increasingly crowded species could induce a self-regulating "social stress syndrome" found in other mammalian species such as recognized by Calhoun (1962) and Christian and Davis (1964). Hoagland (1964) suggests that such a phenomenon may have long existed in the form of an emigration urge responsible for colonization efforts. During the depression years, economic stresses, converted into psychological stresses, caused family size to drop to replacement level. As a result of the 1840's potato famine in Ireland, the original population dropped by 24%. Since then, conscious change in marriage patterns emphasizing non-marriage, late marriage, and small families has occurred. In other cases, even if socially intrinsic stress mechanisms exist, they have been apparently insufficient to regulate population growth. Certainly, this has been true on the global scale. It is conceivable, however, that energy considerations may introduce a systematic feedback loop impacting population growth, which has to date not been experienced by contemporary societies.

Components and implications of population change must remain a critical facet of energy planning. In turn, the growing severity of the energy/resources crisis may impact upon population. In either case, a systems approach including these considerations must tighten the links toward developing well-thought-out solutions concerning the energy crisis.

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**ENERGY FACILITY SITING: DEVELOPMENT OF AN ASSESSMENT*
METHODOLOGY THROUGH A CASE STUDY OF COAL GASIFICATION-COMBINED
CYCLE ON THE CALIFORNIA COAST**

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PREFACE--BACKGROUND FOR THE STUDY

The Environmental Science and Engineering Interdepartmental Graduate Program at UCLA has as its goal the preparation of professionals with a broad understanding of the environment and the technical and organizational skills essential to problem-solving. A key vehicle in their preparation is performance as members of a responsible team of professionals developing case studies involving real problems. The study reported in this paper represents one such activity. For those interested in the detailed assessment and the concept of technology summarized briefly here, copies of the original report volume can be made available (reference 1).

INTRODUCTION

California needs electric power, implying sites compatible with technology, environment, and current institutional constraints. At present, developers must identify sites and defend these through Environmental Impact Reports (EIR). No doubt the burden of proof should be on the developer, but the system promotes an adversary relationship, prolongs discussion, and, with disapproval, creates a loss paid by the consumer. The bickering, inefficient use of talent, and delays of the present process need to be eliminated. This study addresses that need.

The first objective was to formulate an alternative siting methodology which focused both on technology and site suitability characteristics. The intent was to identify limiting factors before preparation of the EIR. The second was to demonstrate the methodology using siting of a hypothetical combined cycle coal gasification plant.

A Power Plant Siting Assessment System (PPSA) is derived from the Southern California EEA's "Energy Technology Environmental Assessment System" (ETEAS). The PPSA pays more attention to institutional constraints and expands environmental considerations. It is intended to be a comprehensive siting methodology which identifies critical factors prior to preparation of the EIR. This permits early mediation of constraints. The second objective required specifying technology for a gasification combined cycle (GCC) plant. Since such a plant does not exist we derived characteristics from available literature of component technologies and pilot plants. For our purpose characteristics need not exactly describe any real plant, and they do not. Characteristic discharges and requirements still are representative enough to demonstrate the methodology. Licensing and regulatory requirements are discussed including distinctions between national, state, and local jurisdictions. Methods to mitigate both environmental and institutional constraints to siting the defined energy technology are suggested.

Overview of Siting/Assessment Procedures

In California, several agencies handle energy matters. The California Energy Resources Conservation and Development Commission (CERCDC), created in 1975, has primary responsibility and certifies new generation facilities. The California Public Utilities Commission (PUC) regulates utility rates. The Coastal Zone Conservation Commission shares siting responsibility in coastal regions.

The siting procedure has two stages: the Notice of Intention (NOI) and the Application for Certification (AFC). Any plant of 100 megawatts or more requires an NOI, a sequence of hearings and analyses (Table 1) that lasts 18 months. The NOI must consider at least three sites and determine if energy is needed and if development at the sites would endanger health and safety or adversely affect environmental quality. After review a decision is made to disapprove the NOI or to approve one or more sites. The utility may submit an

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Table 1
Notice of Intention (NOI) Process

<u>Step</u>	<u>Day</u>
1. Applicant Prepares NOI	
2. Commission Receives NOI	1
3. Data Adequacy Decision	30
a. If inadequate return to applicant	
b. If adequate proceed to Step 4	
4. Summarize NOI	
5. Publish, Circulate and Request Comments	60-90
6. Conduct Initial Hearings	
7. Assess Site and Facility Suitability	
8. Prepare and Publish Preliminary Report	240-270
9. Compile Preliminary Findings and Comments	
10. Optional Hearings if Necessary	
11. Assess Site and Facility Acceptability	
12. Prepare and Publish Final Report	360-390
13. Conduct Hearings	390-420
14. Decision	480-540

Table 2
Application for Certification (AFC) Process

<u>Step</u>	<u>Day</u>
1. Applicant Prepares AFC	
2. Commission Receives AFC	1
3. Data Adequacy Decision	30
a. If not adequate return to applicant	
b. If adequate proceed to Step 4	
4. Summarize AFC	
5. Publish, Circulate and Request Comments	90
6. Prepare Environmental Study	
7. Conduct Initial Hearings	
a. Assess compliance with all laws and standards	
b. Assess conformance with forecast	
8. Draft EIR	
9. Circulate Draft EIR, Solicit Comments	
10. Conduct Hearings	365
11. Final EIR	
12. Decision	540

AFC for an accepted site starting a second eighteen-month sequence (Table 2). Emphasis in the AFC analysis is site-specific design, including preparation of an EIR with the CERCDC as the lead agency.

ENVIRONMENTAL ASSESSMENT METHODOLOGY

Southern California Edison Environmental Assessment System

The Southern California Edison "Energy Technology Environmental Assessment System" (ETEAS) is illustrated in Figure 1. It provides a logical assessment methodology for ecological implications of atmospheric and liquid discharges. The adequacy of the ETEAS is limited, however, because it explores only biological and ecological implications of siting, because confidence and reliability are not specifically addressed and because it contains no weighting factors or criteria that define relative importance. These inadequacies limit usefulness to the interpretation and bias of those reviewing output.

Modification of the SCE Environmental Assessment System

In an attempt to extend the ETEAS into a comprehensive methodology, a Power Plant Siting Assessment System (PPSAS) was developed (Figure 2). The PPSAS is analogous in many respects to the ETEAS system and incorporates it at a proper point. Limitations of the PPSAS are similar to those for the ETEAS. However, it does address all environmental constraints (socio-economic and institutional).

PRELIMINARY SITING

PPSAS first establishes availability of resources required. If all are available, the analysis will continue; however, if even one is not, either a site must be rejected or other changes made. The steps numbered below refer to Figure 2.

Step 1.0 Raw Energy Technology: The Power Plant Siting Assessment System begins by defining a raw energy technology. In this example many smaller technologies are integrated into a system, but the methodology should function for any energy technology.

Step 1.1 Requirements of the Technology: The requirements of the energy technology refer to resources absolutely necessary for its operation as defined in Step 1.0 and include Steps 1.1.1 to 1.1.4 (see reference 1 for details).

Step 2.0 Adequacy of the Needed Resources at the Potential Site: This is the first decision-making step. Availability of requirements at the site must be judged adequate or inadequate.

Step 2.1 Adequate Resources: If resources are adequate the analysis is continued at Step 3.0.

Step 2.2 Inadequate Resources: If resources are inadequate the site is unsuitable as originally defined. Analysis can either stop or continue to Step 10.0 where changes may be made and analysis started again at Step 1.0.

ENVIRONMENTAL CONSIDERATIONS

Broadly defined, environmental considerations are significant impacts which follow siting the plant, and can be physical, biological, socio-economic, or institutional.

Step 3.0 Postoperative Resource Monitoring: The decision is that resources are initially available; however, changes in future resource availability may occur. Thus, continued availability should be monitored.

Step 4.0 Technology Applied to the Site Environmental implications of a tech-

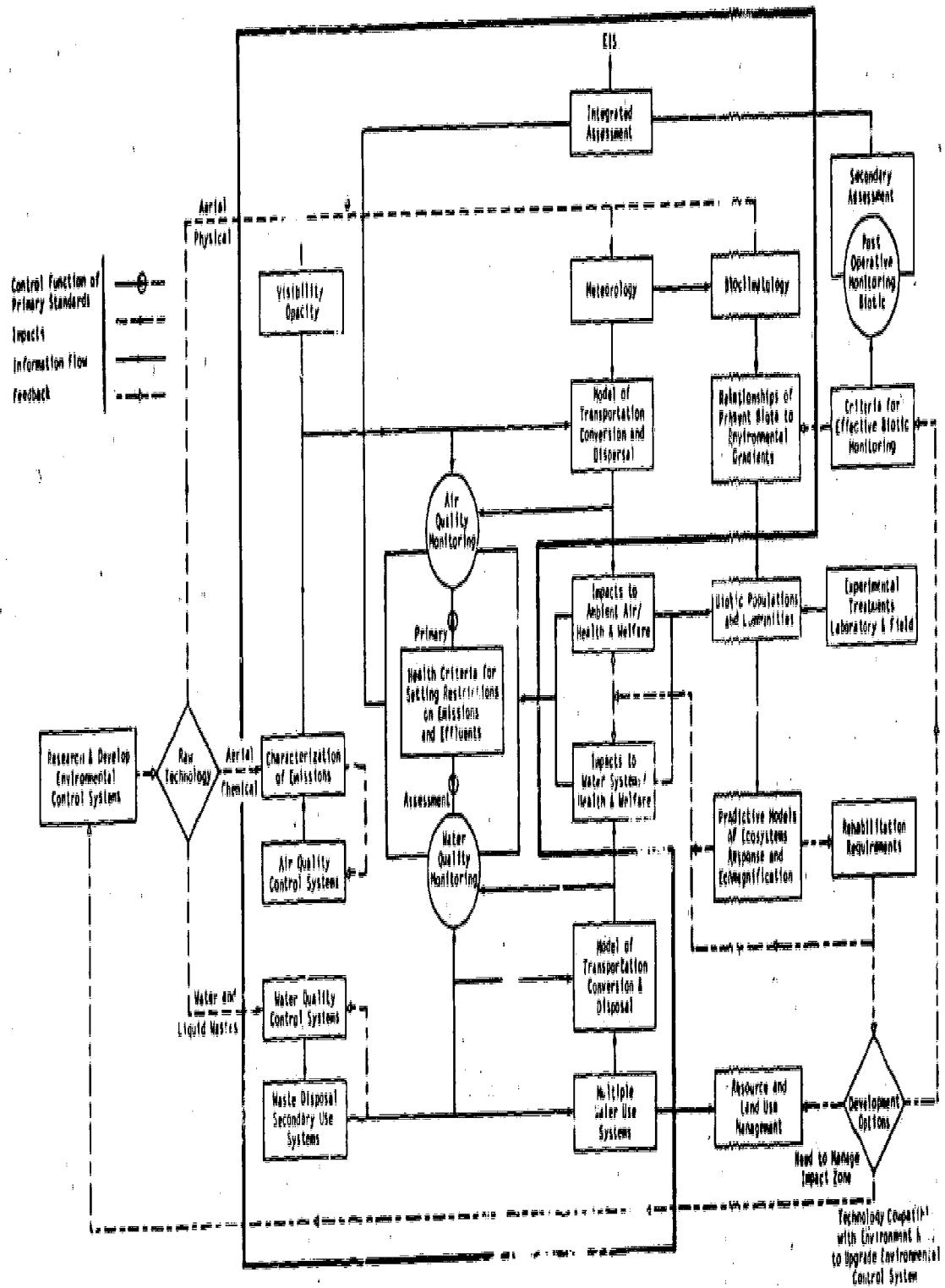


Figure 1 SCE Energy Technology Environmental Assessment System (SCE ETEAS) (The portion of the SCEETEAS not specifically appearing in the PPSAS is enclosed in the solid lines)

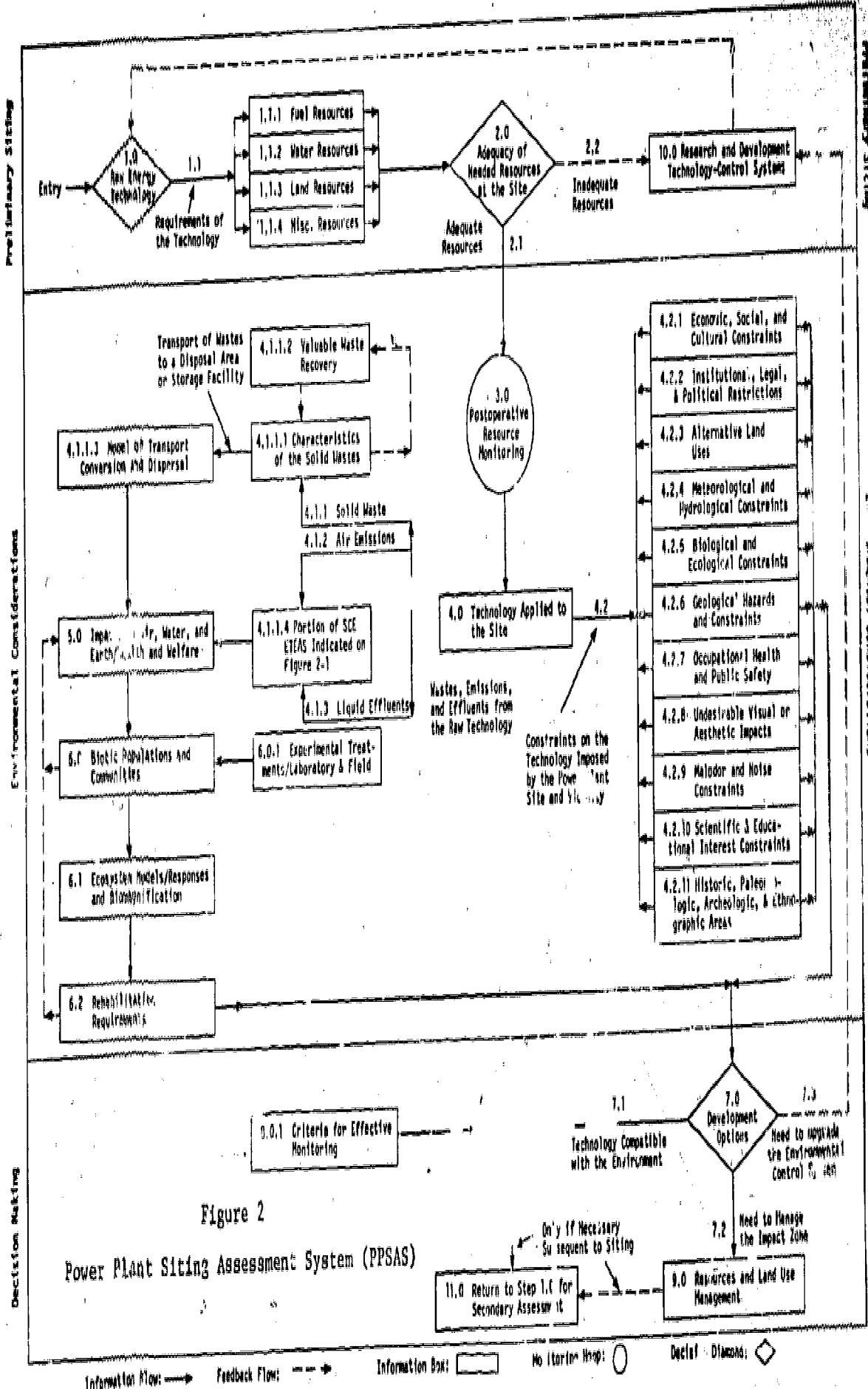


Figure 2
Power Plant Siting Assessment System (PPSAS)

nology fit in two major categories: biological and ecological ramifications of power plant discharges and residuals (Step 4.1); environmental constraints at the site (Step 4.2). The categories are not completely autonomous.

Step 4.1 Wastes, Emissions and Effluents from the Energy Technology: Discharges are identified as solid waste, atmospheric emissions, and liquid effluents. Potentially harmful discharges should be quantified and models of transport, conversion, and dispersal developed. The portion of the ETEAS (Figure 1) not specifically represented in the PPSAS fits into the assessment here.

Step 5.0 Impacts to Air, Water, and Earth--Health and Welfare Implications: Potentially adverse health effects or property damage must be estimated and identified.

Step 6.0 Biotic Populations and Community: Similar to Step 5.0, information flow from the energy technology's discharges plus laboratory and field data (Step 6.0.1) should define potentially adverse impacts. Predictive models should be used as necessary. Feedback from this step may produce changes in Steps 5.0 and 6.0.

Step 6.2 Rehabilitation Requirements: At this point it is possible to estimate measures needed to restore impacted areas, or the extent of ecological insult without rehabilitation. Feedback may affect changes in Steps 5.0, 6.0, and 6.1.

Step 4.2 Constraints on the Energy Technology Imposed by the Power Plant Site and Vicinity: All technologies are likely to impose some adverse environmental effects on potential sites. By categorically addressing generic considerations (Steps 4.2.1 to 4.2.11) "critical environmental factors" should become apparent. Similarly, on a site-specific basis, an investigation of generic environmental constraints should define site suitability for the energy technology.

This path of the PPSAS joins the information path of the other assessment category (Step 4.1) to lead to the decision-making portion of the assessment methodology (Step 7.0).

DECISION MAKING

This portion of the PPSAS synthesizes information processed above to identify development options. Decision-making is the use of expert judgment based on best available information including environmental implications of the energy technology. Citizen participation may subsequently be incorporated into the final decision process.

Step 7.0 Development Options: The decision as to environmental suitability of the potential site results from integrated assessment of information from Step 4.1 and 4.2. Decision options regarding the siting of the energy technology are addressed in Steps 7.1 to 7.3.

Step 7.1 Technology Compatible with the Environment: This option is a "yes" response to the question of suitability. Long-term monitoring (Step 8.0) of impacts is the only requirement for development and submission as a candidate site in the NOI procedure.

Step 7.2 Need to Manage the Impact Zone: This option is a "conditional yes", since the development option is compatible only if the impacted zone is continuously managed (Step 9.0).

Step 7.3 Need to Upgrade the Environmental Control System: This development option requires a "no" response, with acceptance then depending on research and development of technology and control systems (Step 10.0).

Step 10.0 Research and Development of the Technology and Control Systems: If the

site has been rejected for environmental impacts, choosing an alternative site may be most prudent. However, either technology or pollution control might be improved to circumvent adverse impacts. Also, some combination of measures could be taken. Only when every alternative is exhausted or economics prohibits continuing, can the energy technology be considered firmly rejected based on its adverse environmental impacts at the site.

Step 11.0 Secondary Assessment: If adverse impacts become evident after initial acceptance, a secondary assessment would be necessary.

COAL GASIFICATION/COMBINED CYCLE TECHNOLOGY AND ENVIRONMENTAL ASSESSMENT: A CASE STUDY

Synthetic fuel processes increase the hydrogen-carbon ratio of coal. Gasification produces a clean, low-sulfur gas which can be medium, or high Btu content. Here we consider combined cycle power generation using low Btu gas, at a higher overall efficiency than a conventional plant. We also seek lower cooling water requirements, smaller physical size, possibly lower capital cost. Potential advantages of a GCC system led to use with the assessment methodology developed by this study. The present section briefly describes a hypothetical GCC system tailored to our study. Much more detailed information is presented in reference 1. No GCC system in operation at the present time has the combination of components selected for this case study. Thus, we made reasonable technical assumptions. We acknowledge that this leaves results subject to various uncertainties. GCC plant characteristics derive from the literature, using elements of established technologies. We have made no effort to cost the system, though costs were implicit in our evaluation of literature, and should be reasonable.

Gasification--Combined Cycle Plant Overview

The major process steps in the GCC system are as follows:

- Coal preparation--the coal is crushed, water is added and a coal-water slurry is prepared and otherwise pretreated.
- Gasification--the coal, de-watered for combustion in an entrained bed gasifier, is mixed with air or oxygen, pressurized or unpressurized. Some coal provides energy to drive gasification, forming gaseous fuel at up to 90 percent efficiency. Sulfur impurities become hydrogen sulfide.
- Quenching and particulate removal--gas is cooled, heat is recovered, and particulates are removed by wet scrubbing.
- Gas purification--hydrogen sulfide is removed with recovery of sulfur.
- Power generation and heat exchange--clean gas burns in the gas turbine of the combined cycle unit, generating electricity. Heat from the turbine is recovered and generates steam, driving a steam turbine and generating more electricity.

Some advantages of the GCC power generation system when compared with conventional coal-fired power plants include:

- Sulfur dioxide emissions may be controlled using regenerable absorbents for removal of hydrogen sulfide from the gas stream. This eliminates flue gas desulfurization and associated solids disposal, and offers potential for more complete control.
- Nitrogen oxide (NO_x) emissions will be lower because fuel nitrogen is converted to ammonia in the gasifier, and removed with wastewater. Also low-moderate Btu gas should burn with low NO_x formation.
- Overall efficiency of a GCC plant is expected to be equivalent to or greater than conventional coal-fired plants (overall 38 percent or more efficiency with an annual capacity factor of 65 percent).
- Less cooling water is required for a GCC system.

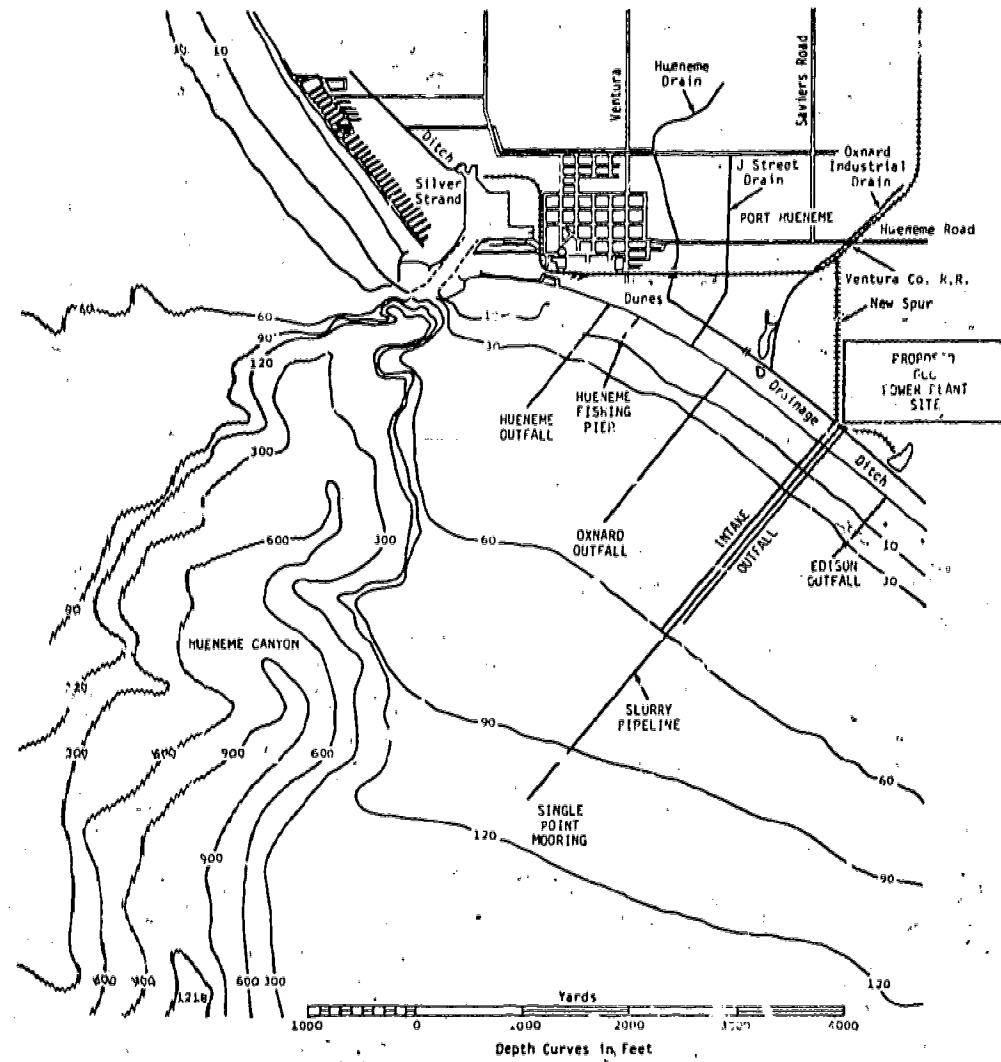


Figure 3
The Location of the Single Point Mooring System
Relative to the Proposed FCC Plant Site

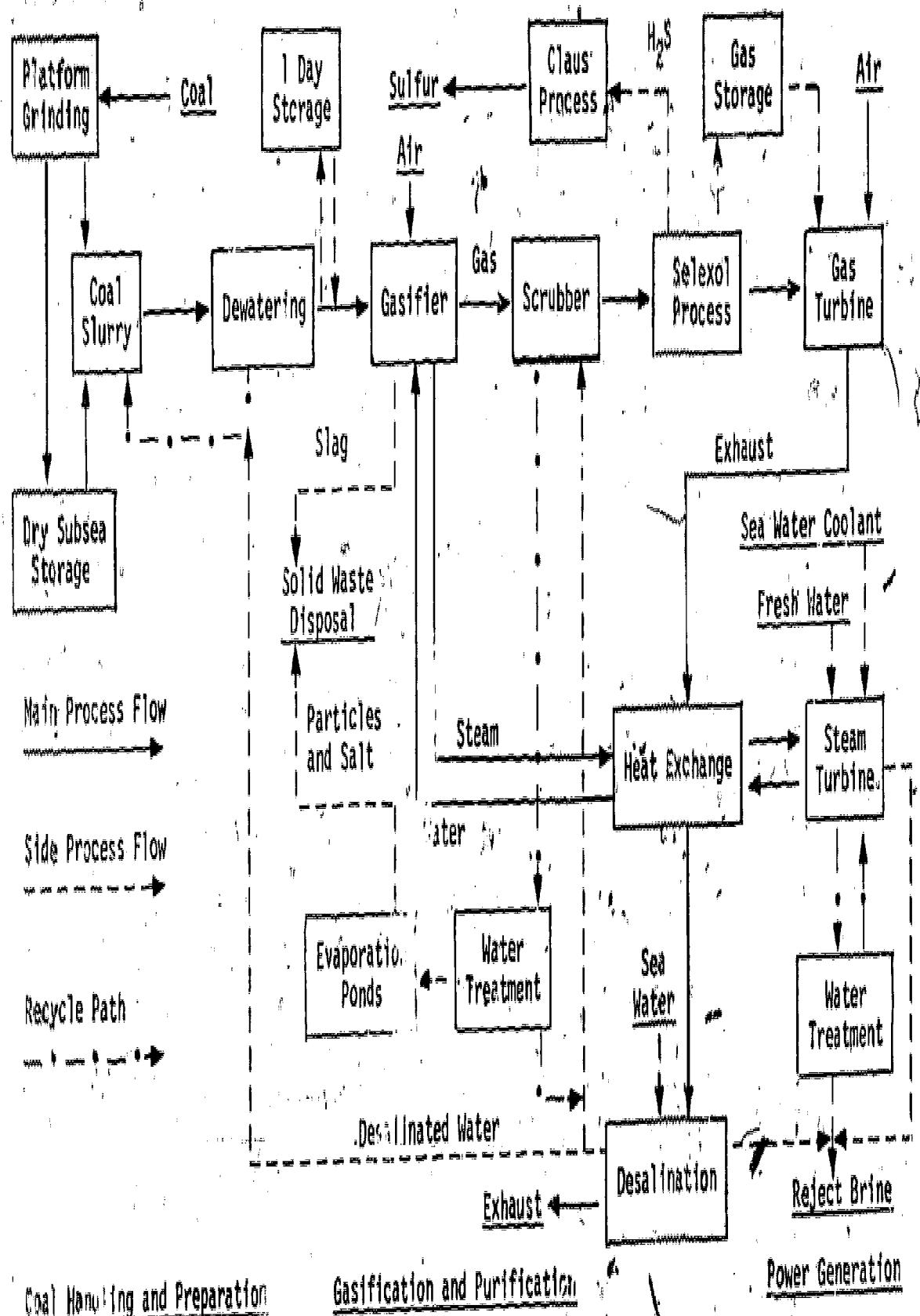


Figure 4 Coal Gasification/Combined System

Table 3
Land Requirements

Specifications	Quantity		Remarks
	Hectares	Acres	
Coal Conversion	6	15	
Power Generation	6	15	4 Units Gas Turbine
Gas Storage	1.5	3.8	2 Hours
Interim Solid Waste Storage	0.2	0.4	2 Weeks
Solid Waste Disposal	104	256	35 Years
Evaporation Ponds	76.9 ⁰	190	20 ponds with 0.1 in/day evaporation rate
Temporary Coal Storage*	1.5	3.7	2 Days
Sulfur Storage	**	**	2 Weeks
Miscellaneous and Buffer (about 20 percent)	17.9	44.2	
Total (Excluding Solid Waste Disposal Land)	110	272	

* A 2 weeks' coal storage offshore, on the ocean floor.

** Much less than an acre.

Table 4
Water Requirements

Specifications	Quantity m ³ /day	Remarks
Desalinated Sea Water		3500 ppm TDS
Scrubbing	2960	97% Recycling
Coal Slurry	1370	89.5% Recycling
Salt Water		35,000 ppm TDS
Cooling Water	2.21 x 10 ⁶	Once Thru at ΔT = 8°C
Fresh Water		
Boiler Makeup, Rinse Blowdown	250	

Disadvantages include:

- The lack of experience in the power industry with the gasification processes and sulfur removal systems hypothesized.
- The economic competitiveness of the GCC system by comparison with conventional coal-fired power plants remains to be proven.

The very low emissions targets for a GCC system might well be considered infeasible by all past experience, due to economic constraints. However, our goal is to first establish what is technically possible and then permit environmental/economic tradeoffs to be made, leading to definition of a "feasible" process.

Four sets of site-specific technology assumptions must be made to quantify total environmental impacts from the GCC plant at the chosen coastal site in Oxnard, California. These relate to coal source and transportation, coal handling and storage, heat rejection from the combined cycle unit, and solid waste disposal and storage.

Transportation cost limits coal sources to Alaskan and Western fields. The Beluga field in Alaska is assumed to be the sole source of coal supply (2), though there are several Western states fields (3).

Once a coal carrying ship arrives, a relaying system must carry coal ashore. Based on review of the options, a single point mooring system much as used for oil was adopted, coupled with slurry transport. It avoids port congestion, minimizes disturbance to sand dunes and littoral sand transport, and can provide rapid, direct transport of coal to storage and to shore. Figure 3 shows the proposed location of this system as it would appear in operation and offshore seabed profiles. Since a shipment may be late, a storage facility is required. For this study we assume storage in subsea concrete silos with grinding taking place on a platform and crushed coal dropped into subsea tanks. Coal would be retrieved and carried to the GCC plant via a slurry line.

Coastal siting permits using once-through ocean cooling. If there is an 8°C net temperature increase in cooling water, $2.21 \times 10^6 \text{ m}^3/\text{day}$ of ocean water would be required. The intake and outfall conduits extend about 2.2 and 2.0 kilometers offshore, respectively, well below the thermocline. Temperatures at the intake and outfall are about $10\text{--}12^{\circ}\text{C}$, while ocean surface temperature varies from $15\text{--}20^{\circ}\text{C}$.

Solid waste quantities depend on ash content of coal. Total dissolved solids from scrubbing water contribute some waste. Potential toxic substances, such as heavy metals and certain polycyclic aromatics, may be present. Thus, we must consider this as Group I solid waste, slated for a Class 1 site. Currently used sites in southern California will not have capacity to handle the waste from the GCC plant. Thus, other potential sites nearby must be developed. Solid waste is to be carried from interim storage every ten days by rail to a Mojave desert site for permanent disposal.

Figure 4 presents an outline of the GCC power generation systems tailored to our study. Alaskan coal will be brought by ship to be handled using a single point mooring system and associated off-loading facilities. Coal will be stored in subsea concrete storage silos. It will then be slurried to shore and dewatered to the right water-to-coal ratio for gasification. Solid waste will be stored up to two weeks before shipment to disposal sites. Once-through cooling will take up heat ultimately rejected from the combined cycle unit. Some energy from heat exchange will partially desalinate ocean water to about 3,500 ppm TDS for use in gasifier, slurry and wet scrubber systems.

Tables 3 through 5 summarize the land, water, and fuel requirements for the site-specific GCC system, and Table 6 presents the types of discharges from this system and their magnitude.

Natural Environment

The site is about 20 miles west (up the coast) of Los Angeles, on the Oxnard Plain near Ormond Beach. The broad, flat alluvial plain contains several small fans washed down from the low foothills. The coastal plain contains alluvial sands and gravels, loamy soils and clays, and sand dunes. It has minimal erosion and landslide potential, but poor drainage. The saturated surface is subject to potential liquefaction in the upper 4 to 6 meters during earthquake-generated ground shaking. Although several active faults exist both onshore and in the Santa Barbara Channel, the Oxnard Plain experiences fewer intensive seismic activities than surrounding areas. The most recent movements occurred offshore, producing the Port Hueneme earthquake of 1957 (Richter magnitude 4.7) and the Point Mugu earthquake of 1973 (Richter magnitude 6.0). No known active or potentially active faults are at the site, but seismic hazards such as tsunamis and liquefaction are considered the greatest potential risk to public safety.

Because Ormond Beach has rapid sand movement by longshore currents, sand must sometimes bypass the Port Hueneme jetties, which block littoral transport, to replenish erosional losses downcoast. Approximately 4 kilometers downcoast is Mugu estuary and lagoon, also one of the last undisturbed salt marshes in southern California. The wide (approximately 7.2 kilometers), gently sloping shelf offshore is bordered by two deep submarine canyons at Port Hueneme and Point Mugu. Surface circulation in the Santa Barbara Channel is a large eddy with a clockwise gyre. Surface current nearby is southeasterly, parallel to the coastline, all year. Annual ocean temperature patterns include cool isothermal winter, water warming in spring, which by late summer develops into a deep thermocline with maximum surface temperatures and diminishes during fall. Surface temperatures usually range from 15° to 20°C.

During spring and summer, daytime westerly sea breezes flow across the Oxnard Plain and through the Santa Clara Valley. At night, the wind reverses direction and flows down the valley and out to the ocean. Northeasterly drainage land breezes are dominant during fall and winter, with occasional dry and gusty Santa Ana winds. Generally climate is mild, with warm, dry summers and cool, wet winters. Temperature varies little and relative humidity is usually moderate to high. Winter migratory storms contribute most rainfall (37 centimeters per year). Subsidence atmospheric inversions are caused by the semi-permanent Pacific high-pressure system offshore, and intrusion of cold marine air beneath warmer land air is common. Thermal inversions decrease vertical mixing in the lower troposphere, reducing dispersion of air pollutants. Generally, sea breezes carry pollutants inland, giving the coast best ambient air quality.

There are no natural fresh water bodies near the site. Southeast are private, man-made duck ponds, and northeast a drainage system that deposits industrial and agricultural waste below the Hueneme Fishing Pier. In addition, two sewage outfalls and cooling water discharge along Ormond Beach.

The coastal strand, salt marsh, and coastal marine flora and fauna are typical for southern California. Three rare and endangered species could be affected: the three-spined unarmored stickleback (Gasterosteus aculeatus williamsoni) is abundant and reproducing in the Oxnard Industrial Drain; the California least tern (Sterna albifrons brownii) is a migratory bird found nesting on Ormond Beach; and the Belding's savannah sparrow (Passerculus sandwichensis) is a residential bird known to inhabit the marshes at the Santa Clara River mouth and on Ormond Beach.

Human Environment

The fertile Oxnard Plain supports a productive agricultural industry and also is one of California's fastest-growing urban areas; the January 1975 special census gave a total population in Ventura County of 432,407. Major urban centers are Oxnard, Camarillo, and Port Hueneme. The project area receives full public

services from the County, cities, and districts. Utilities serving the area include electricity and gas by the Southern California Edison Company, water from Oxnard-owned wells and the Southern California Metropolitan Water District, and telephone from General Telephone Company of California. Solid waste is managed by the Ventura County Sanitation District. The proposed site is currently zoned for industrial use though leased for agriculture.

In August 1975, unemployment in Ventura County was 9.3 percent. Average 1974 personal family income for Oxnard (\$10,373) was comparable to Ventura County. 1975-76 assessed value in Ventura County was about \$1.6 billion, \$289 million of which was for the City of Oxnard (up 13 percent from 1973-74).

The Ormond Beach landscape could be considered to retain some scenic quality because of the open agricultural plain and strand beach. However, heavy industries near the site include a chemical plant, forging mill, stamping mill, and a 1500-Megawatt oil-fired electric power plant. Also many human artifacts litter the beach. No important historical sites are in the project area and no known archaeological sites within 6.4 kilometers.

Institutional Arrangements

The Warren-Alquist Act, AB 1575, grants the Energy Resources Conservation and Development Commission (ERCDC) exclusive power to certify all sites and related facilities in California. A certificate by ERCDC is in lieu of any document required by any state, local or regional agency, or federal agency to the extent permitted by federal law. However, permits issued by the local Air Pollution Control District and the Regional Water Quality Control Board cannot be preempted by ERCDC.

The site lies on the boundary between the City of Oxnard and unincorporated Ventura County. To get a conditional use permit, the unincorporated area must first be annexed. Permit authority for the County lies in the Ventura County Air Pollution Control District, Flood Control and Drainage Department, and possibly the Public Works Department. All other local permits will be from Oxnard. The site currently is zoned for industrial use, and is not under the County's Land Conservation Program (Williamson Act).

Under the current statute, the ERCDC must transmit a copy of the NOI to the Attorney General and to all federal, state, regional, and local agencies with an interest. The ERCDC also must request comments and recommendations. The list of agencies is lengthy, and the public may present its position during hearings.

Important local regulatory constraints which differ from state or federal regulations are imposed by the Ventura County Air Pollution Control District. Ventura has some of the most stringent limitations in the state, reflecting a policy of controlled development.

APPLICATION OF THE ASSESSMENT METHODOLOGY

From the description of the proposed facility and assumptions presented, environmental constraints on the technology were identified and the PPSAS applied.

Identification of Critical Environmental Factors

Step 1.0 With technology defined (see Figure 2), resources required were estimated. These are identified in Tables 4 to 6. Several unanswered questions are apparent.

Step 1.1.1 Fuel Resources: adequate.

Step 1.1.2 Water Resources: available.

Step 1.1.3 Land Resources: The largest on-site requirement is for evaporation ponds to remove waste from slurry and boiler wash. On-site land is available.

A remote area is needed for solid waste, meeting state criteria for unlimited Class I disposal sites. Scarcity of such areas identified this as a significant problem for siting a GCC facility at Ormond Beach.

Step 1.1.4 Miscellaneous Resources: assumed available.

Step 2.0 Adequacy of Needed Resources at the Site: Nearly all resources required are available. The preliminary siting portion of the PPSAS suggests that siting for solid waste disposal be satisfactorily resolved before proceeding further. Several potential Class I disposal areas are available and located within 200 kilometers. Transporting wastes introduces other constraints, but satisfying the land resource requirement allows assessment to continue.

Step 4.0 Technology Applied to the Site

Step 4.1 Wastes, Emissions, and Effluents from the Energy Technology: Atmospheric emissions, liquid effluents, and solid wastes associated with our GCC facility are described in Table 6. A model of transport, conversion, and dispersal of all wastes corresponding to Step 4.1.1.3 and analogous Steps in the ETEAS (Figure 1) for atmospheric emissions and liquid effluents was not available. The brevity of analysis here does not allow development of such models, but to do so is recommended in an actual case study.

Step 4.1.1 Solid Wastes: Slag from coal gasifiers consists of abundant elements (aluminum, iron, calcium, and silicon) and many minor and trace elements. Sludge accumulates from evaporation of wastewater. Both are considered Group I wastes and, in the absence of better information, require Class I disposal sites. Sulfur removed as hydrogen sulfide is subsequently oxidized and removed as elemental sulfur. The sulfur produced could be sold, and exemplifies Step 4.1.1.2, valuable waste recovery.

Step 4.1.2 Atmospheric Emissions: Primary air pollutants released are identified and quantified in Table 6. Only for oxides of nitrogen are emission standards of the Ventura County Air Pollution Control District likely to be exceeded. The design uses best available technology for sulfur and particulates. Constraints on licensing new sources make it unlikely that permits for a facility which exceeds standards can be obtained. Thus, emission of oxides of nitrogen is a critical environmental factor which may constrain siting the GCC at Ormond Beach.

Step 4.1.3 Liquid Effluents: Table 6 gives liquid effluents from the proposed GCC facility. Ocean water for once-through cooling is the first. It is expected to have only a slightly higher salt concentration than incoming water, and to be slightly warmer. It meets standards (4) and is not expected to affect ecological communities adversely. The second liquid effluent is wastewater from boilers and scrubbers. This will be diverted to impermeably-lined evaporation ponds. On evaporation, sludge will be removed as solid waste (see Step 4.1.1).

Steps 5.0 to 6.2 Biological and Ecological Impacts from Discharges: Without models an extensive analysis of biological and ecological impacts of discharges cannot be made. Superficially, solid wastes are expected to impact only surface ecology of Class I disposal sites, while liquid wastes and thermal effluent are not thought to have adverse impacts. Emission of oxides of nitrogen is the only significant air pollution and has been identified as a critical environmental factor deserving further scrutiny.

Step 4.2 Constraints on the Energy Technology Imposed on the Power Plant Site and Vicinity: Virtually every potential power plant site probably has characteristics which would be adversely affected by any energy technology there. Similarly, many sites may have characteristics which preclude siting. Prior to selecting a site as a candidate for final approval (e.g., the NOI process), environmental constraints imposed by the site on energy technology should be identified. Mitigation then may be sought to make the technology acceptable and improve chances for siting.

Step 4.2.1 Economic, Social, and Cultural Constraints: Several facility components may have greater capital costs than a conventional unit for similar capacity. Similarly, increased operating costs may come from storage and disposal of voluminous solid wastes.

Social stigmas are associated with the utilization of coal. It is dirty technology with significant air pollution problems. Several aspects of the facility may be criticized by environmental groups including: 1) close proximity to Mugu estuary; 2) possible adverse impacts on endangered species; 3) ecological changes associated with undersea coal storage; and 4) generation and disposal of voluminous Group I wastes.

Step 4.2.2 Institutional, Legal, and Political Restrictions: Obtaining requisite permits, certifications, and approvals is a frustrating and arduous endeavor. The institutional, legal, and political obstacles which impede construction of a large power facility are so complex that together they are identified as a critical factor which may ultimately affect successful siting.

Step 4.2.3 Alternative Land Uses: Land designated as the site for the proposed facility is currently zoned for heavy industrial use, with ownership shared by Pacific Lighting Corporation and Southern California Edison Company. A large area is needed at the site for evaporation ponds, and at some site for solid waste storage and disposal. Conflict for relatively scarce Class I disposal sites may arise with far-sighted industrial groups.

Step 4.2.4 Meteorological and Hydrological Constraints: Since air pollution has been identified as a critical environmental factor (Step 4.1.2), it follows that meteorology is important, especially wind speed and direction, and frequency and persistence of temperature inversions. Meteorological conditions are typical of coastal areas in southern California with seasonal and diurnal changes in wind speed and direction. Temperature inversions forming barriers to vertical mixing are common. Tracer studies have indicated areas affected by air pollution from the existing plant at Ormond Beach (5). No significant hydrological problems were identified.

Step 4.2.5 Biological and Ecological Constraints at the Site: No critical biological habitats or fragile ecological communities have been identified within the site. A small salt water marsh and grassland are adjacent and, while disturbed and debris-laden, could potentially be managed as a significant biological habitat. Two endangered bird species, the Belding's savannah sparrow and the California least tern, are known to nest in the area; however, the California least tern has not been observed nesting in the area since 1974. Mugu Lagoon, the single remaining natural estuary in southern California, is located about three kilometers to the south. It is of critical biological and ecological importance. Routine construction and operation should not significantly affect it, however.

Step 4.2.6 Geological Hazards and Constraints: No significant geological hazards are associated with the proposed GCC facility site, though some capacity for soil liquefaction exists. Proper reinforcement of structures should be provided.

Step 4.2.7 Occupational Health and Public Safety: Occupational health and safety of employees should be comparable to other coal-burning plants. However, coal transportation risks and those from operation storage have not been determined.

Step 4.2.8 Undesirable Aesthetic and Visual Impacts: Because a large generation facility is already located at Ormond Beach, visual impact of another plant should be minimal. Existing transmission lines are adequate to carry power. Transports unloading coal will be visible from much of the coastline; however, distance minimizes visual impact.

Step 4.2.9 Malodor and Noise Constraints: manageable.

Step 4.2.10 Scientific and Educational Interest Constraints: none.

Step 4.2.11 Historic, Paleontologic, and Archaeologic Constraints: none.

Step 7.0 Development Options: The PPSAS has identified several critical environmental factors for siting a GCC facility at Ormond Beach. These include possibly excessive oxides of nitrogen; transportation and disposal of solid wastes; and complex institutional, legal, and political constraints. In addition, several factors associated with undersea coal storage include economic, social, ecological and safety aspects of the structure and system. With these four critical factors, a negative decision could result (Step 7.0). That is, the Ormond Beach location probably is not environmentally suitable for siting the GCC energy technology as presently defined in Step 1.0.

Step 10.0 Research and Development of the Technology and Control Systems: We now consider mitigating alternatives to make the energy technology more environmentally acceptable at the proposed site. A more discerning analysis of the critical environmental factors with their possible mitigating options follows.

CRITICAL ENVIRONMENTAL AND INSTITUTIONAL FACTORS

Oxides of Nitrogen

The integrated GCC plant must comply with stringent local NO_x emissions; 140 lb/hr. This is about 20 ppm based on volume discharged from the proposed plant. Emissions are envisioned to lie between 10 and 40 ppm (31 to 125 kg/hr), substantially lower than conventional gas-fired power plant NO_x emissions, about 200 ppm (6). Yet at the upper limit they would exceed the standard. Meteorological conditions aggravate the NO_x problem. Pollutants are frequently carried into Los Angeles County. Tracer experiments indicate transport to Lennox in the Los Angeles Basin, as well as inland into the San Fernando Valley as far east as Burbank (5). The assessment thus has identified NO_x control as a potential major problem. In addition to technical controls, a further mitigating option is the tradeoff provision under the New Source Review rules.

Identification of Mitigating Options

Two fundamentally different control approaches are combustion modification and flue gas treatment. Combustion modification is the near-term technology of choice, but flue gas treatment has potential for high NO_x removal efficiency. Their effects are additive, so combinations of methods can result in substantial reduction (7-11). The Exxon thermal CeNO_x process seems relatively promising and has been proven in a commercial furnace. The present trend in control suggests that levels of 20 ppm and less will be routinely attainable by 1985.

Solid Waste Storage and Disposal

Preliminary studies of gasification solid waste indicate eventual use of slag as a secondary resource material. Characteristics of the GCC slag and sludge make it potentially hazardous, thus special disposal and storage are necessary. A 1000 Mw(e) plant at 100 percent capacity factor produces about 625 cubic meters of waste, weighing about 1,300 tons daily. This equals about 18 freight car loads. Slag from the gasifier (75 percent) consists mostly of devolatilized char that is vitrified. Sludge from evaporated scrubber water (25 percent) contains fine particulates, ocean salts, organic compounds, volatile trace metals, ammonia, and sulfur compounds. Because of the potential leachability of brine salts and toxic materials, this waste also is a Group I material.

Identification of Mitigating Options

Added disposal sites are essential, and the most promising are in closed, bedrock desert basins. While dry desert lakes are underlain by permeable sand, gravel, and coarse sediments, the central playas are underlain with impervious clays. Groundwater reservoirs exist below the basins. However, high dissolved solid

levels make water quality poor and of limited use. Occasional flash floods reach depths of a few feet, but solid waste could be isolated from flooding. Transporting waste to a Class 1 site in California appears to be the best solution available; technically, politically, and socially acceptable.

Coal Storage

As part of an innovative supply/handling system, coal shipped from Alaska would be transferred at a single point mooring platform to be ground, stored in subsea silos, then retrieved via a slurry line and fed into the gasifier. This is considered environmentally advantageous because dust emissions and noise pollution would be reduced onshore; health would be improved, and land for storage could be used for other purposes. There is no known experience with a coal handling and storage system as proposed. However, earlier and recent communication with builders of North Sea offshore concrete structures indicates that the system should be commercially feasible (12, 13). Costs are uncertain and constitute the major disadvantage.

Identification of Mitigating Options

Due to cost uncertainties, use of on-land silos is the preferred alternative. It mitigates coal dust and occupies less land than some options. Costs should be moderate and technology is established.

The Permitting and Licensing Process

Prior to passage of A.B. 1575 in 1975, several state and local agencies shared permit authority for construction and operation of a California power plant. With A.B. 1575 the legislature sought to place responsibility for approval in the newly created California Energy Resources Conservation and Development Commission (14). Application of the Power Plant Siting Assessment System (PPSAS) has identified precise interpretation of the Act as it affects jurisdictional relationships as a critical factor in the siting of a GCC plant.

A major issue to be decided with respect to the jurisdictional relationship is to what extent local agencies are permitted to regulate or prohibit construction and operation of power plants within their borders (15). A.B. 1575 states that the CERCDC has "exclusive power to certify all sites and related facilities in the state". A state law which so completely occupies the field is held to preempt local ordinances, regulations and standards. A provision of A.B. 1575 prohibits any power plant that does not conform with local standards or laws, but local agencies have no power to force compliance through permit processes. The law also provides authority to supersede any applicable local, state, regional, and federal law or regulation to the extent permitted by federal law if the commission finds that the proposed plant is "necessary for public convenience and necessity and that there are not more prudent and feasible means of achieving such public convenience and necessity".

With respect to permits issued by local air pollution control districts (APCDs) and regional Water Quality Control Boards (WQCBs), the CERCDC has no authority to preempt federal standards promulgated under the Clean Air Act and Federal Water Pollution Control Act. Local APCDs and regional WQCBs set air and water quality standards, by means such as New Source Review Rules (NSR) and New Source Performance Standards (NSPS) as required by the Federal Clean Air Act (CAA) (16). In our case, these regulations apply through Rule 26 and Rules 59 and 60, respectively. NSR and NSPS are incorporated into the State Implementation Plan (SIP), and when approved by EPA become federal regulations under the Clean Air Act (CAA). Similarly, under the Federal Water Pollution Control Act (FWPCA), EPA has promulgated regulations binding on regional Water Quality Control Boards and incorporated into the standards set for power plant discharge (17, 18). Thus local APCD permits and regional WQCB permits will be required prior to issuance of the encompassing permit by the CERCDC.

The real significance of A.B. 1575 is in its recognition that electrical energy

generation is essential to the health, safety, and welfare of the people and to the economy, and that state government must ensure a reliable supply at a level consistent with energy need, protection of health and safety, and environmental quality. Consistent with democratic principles, CERCDC must give great weight to concerns of cities and counties. Open public hearings are held before a decision is made.

One criticism of this approach is that the prior permit system enabled local agencies to ask questions and through permits to shape standards to contours of the specific project. The prior process also gave governments an important enforcement tool. Now the local agency may have to seek judicial relief when standards are violated. This encourages resolution of complex, technical problems by the courts rather than by administrative agencies set up to handle the problem in a simpler way.

SUMMARY

Significant environmental problems associated with the defined GCC facility at the proposed Ormond Beach site were identified. The "critical environmental factors" which could become obstacles to successfully siting the power plant were discussed together with possible mitigating alternatives. As a result an environmentally preferred technology can be proposed to lessen impacts.

Perspective of Coal Gasification Combined Cycle Power Plant Siting in California

The technology selected for the case study is not implemented at present in its integrated form and is therefore subject to various uncertainties. While these may raise questions concerning accuracy of the assessment, they do not compromise the primary purpose of this study, which was to demonstrate how the Power Plant Siting Assessment System (PPSAS) may facilitate identification of sites which are environmentally suitable for a given energy technology. They also do not reduce the educational value of the study. However, for the purposes of completeness, it is appropriate to point out these uncertainties.

ACKNOWLEDGEMENTS

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14. Public Resource Code, Section 25000 et seq.
15. County Air Pollution Control Districts are not considered local agencies in this context. The California Supreme Court in the case of Orange County Air Pollution Control Dist. v. Public Util. Com., 4 Cal. 3D 945 (1971) held that although local ordinances are generally controlled by, and subject to, general state laws and the regulations of statewide agencies regarding matters of statewide concern, air pollution control districts have more than local powers, and their rules are enforceable against any state or local government agency.
16. 40 CFR 51:18, 60.
17. 40 CFR 100.
18. 40 CFR 51.18(b), FWPCA, sec. 402.

SYSTEMS

One of the major themes of the conference was "Systems Approaches to Environmental Problems." An intensive workshop on this topic was held by the Environmental Studies Section at George William College at Lake Geneva, Wisconsin during the two days preceding the conference. Jerry Berbeka's paper is a report on that workshop. He outlines the philosophy and content, describes the goals and the format, and discusses the results and evaluation of the workshop.

The systems theme was carried into the conference by a symposium on Systems Approaches to Urban Environmental Problems and by the presentations of a major paper by Lynton Caldwell. Dr. Caldwell's paper also focused on the urban system. He calls for an "experimental" approach to improving the quality of urban life and states that "general systems thinking offers the most promising approach to experiments with cities." He cautions that any systems approach to our cities' environmental problems must include a realistic assessment of difficult social and behavioral factors.

Panel members for the Symposium were: Judith Stockdale, Director of the Chicago Open Lands Project; Allan Schnaiberg, Chairman of the Department of Sociology at Northwestern University; H. Wallace Poston, Commissioner, Chicago Department of Environmental Control; and Daniel Swartzman from the University of Illinois School of Public Health. The three papers included here reflect the comments made by Mr. Poston, Mr. Swartzman and Dr. Schnaiberg during the symposium. Wallace Poston's paper outlines steps taken by the City of Chicago to improve environmental quality, especially air quality. Daniel Swartzman describes the emergence of the "professional environmentalists" and how these advocates have become part of the "system." He offers a model designed to clarify the complexity of environmental problems and the roles that professional environmentalists will play in seeking solutions to these problems. Allan Schnaiberg cautions us that a "concern for social welfare" must accompany our concern for environmental protection.

SYSTEMS APPROACHES IN ENVIRONMENTAL STUDIES: A REPORT ON THE
LAKE GENEVA PRE-CONFERENCE WORKSHOP

Jerry Berberet¹

Participants in the NAAE pre-Conference workshop on the campus of George Williams College at Lake Geneva, Wisconsin, April 28-30, 1978, learned fundamental principles and methods of systems model building, and gained insights about applications of the modeling process for classroom and real world situations. Entitled "Systems Approaches in Environmental Studies," the workshop was designed to build upon the 1977 NAAE pre-Conference workshop in Estes Park which explored experiential learning possibilities for environmental education programs.

True to the heterogeneous character of NAAE itself, the workshop attracted a diverse cast of participants from every major region of the United States. They included college and university faculty members from a variety of disciplines, university administrators at several levels, environmental professionals from government agencies, and graduate and undergraduate students. In response to the enthusiasm generated at Estes Park and Lake Geneva, the Environmental Studies Section of NAAE plans to continue to sponsor a workshop each year just prior to the annual conference.

Environmental educators have long embraced the notion of holistic or systemic thinking as a guiding concept. Many educators have developed fairly effective methods to demonstrate ecological principles of the natural world to their students. Yet, short of highly complex, quantitative models which usually must be programmed on a computer, limited progress has been made in evolving methods to illustrate concretely interdependent relationships among the physical, biological, and human components of the Earth system. Even less progress has been made in using systems analysis to express alternatives in the substance and process of environmental decisionmaking which policymakers, educators, and the general public can understand and apply.

The goal of the Lake Geneva workshop was to gain a familiarity with the rudiments of systems modeling which could be applied to actual environmental problems analyzed for decisionmaking in the classroom or public policy arena. The aim was to identify relationships linking analysis and policymaking, while defining a role for education both within the classroom and outside it involving the public at large. If successful, the workshop would begin to develop a real world systems model for environmental decision-making which would extend holistic thinking beyond its usual role as a descriptive view of the Earth. In short, the workshop attempted to analyze problems systemically as a basis to develop models for problem-solving.

Calvin DeWitt, Professor of Environmental Studies at the University of Wisconsin-Madison, and Robert Friedman, a Wisconsin doctoral candidate, provided both information and direction in their roles as workshop facilitators. They emphasized that systems approaches recognize explicitly that all conceptualization involves an association of relationships. Systems thinking, therefore, becomes a useful tool to order the analytical process. As a tool, it enables the analyst to consider variables and interrelationships, while transcending the piecemeal confines of traditional academic disciplines.

DeWitt and Friedman stress that (in the real world) policymakers constantly make decisions based upon whatever data they have at hand. The fact that data are often fragmented and incomplete, may have little bearing on the timing of these decisions. Yet, because they are accustomed to responding to a diversity of influences, policymakers frequently are keenly sensitive to dynamics of the real world system. An important benefit of modeling is the opportunity to simulate the effects of alternative decisions upon the real system at minimal social cost, and with the

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freedom to make mistakes with minimal consequence. Systems models which can be expressed clearly and concisely, therefore, hold promise as a means of improving the quality of environmental decisionmaking.

The potential value of systems analysis as a policymaking tool has been discredited somewhat by the tendency of systems analysts to build grandiose general purpose models. The controversy which the Club of Rome's Limits to Growth model generated is just such an example. According to DeWitt and Friedman, general purpose models have proven to be of limited value in solving specific problems. Moreover, the attempt to replicate the real system entirely in a computer model is a process which makes the model so highly complex and quantitative that it becomes incomprehensible to most policymakers and the general public. Finally, model builders too often use jargon and technical language unfamiliar to most persons.

- DeWitt and Friedman contend that useful models focus upon specific problems of manageable scope, usually problems which can be stated in the form of a question, e.g., How many additional lakeshore residential sewer systems can be permitted without jeopardizing the water quality of Lake Geneva? Useful models represent attempts to isolate key variables or indicators which explain a system's behavior (analogous to limiting factors in ecology). Such models serve as valuable guides in data collection and employ plain language, simple equations, and noncomputer techniques as much as possible, in order that they may be widely understood and interpreted. When directed at specific problems, models also have the advantage of limiting distortions due to faulty assumptions and data which inevitably creep into them.

The workshop format (see schedule, Appendix I) included sessions in which the thirty-five participants reviewed basic elements of systems theory and model development, undertook small group model building exercises around the environmental problems each group identified, presented and critiqued models the small groups constructed, and discussed policy and educational applications of the models. The workshop was structured to enhance interdisciplinary team building and evaluation.

Model building includes a number of distinct steps (see diagram, Appendix II). A specific and accurate statement of the problem in the form of a question is the critical initial step. This is followed by identification of system components of the problem, development of a matrix to identify relationships of the components, construction of a flowchart to plot the activity of the system over time, and composition of equations to express relationships of the components in precise terms. The foregoing analytical procedures are followed by calculations, including use of a computer if necessary. The model is then tested and validated against the real world system it replicates. Assumptions about the problem solution are then specified. Revisions are made as appropriate through repetition of the steps in the model building process.

The workshop small groups chose a variety of problems for the model-building exercise:

1. What would be the effects on the nuclear family in "Fuelsville, Wisconsin" of replacing all fuels with wood?
2. How do we minimize socio/economic/environmental costs per kilowatt hour in a public utilities service area?
3. What basic factors will affect future world food productivity?
4. How can traditional patterns of personal residential energy use be lowered?
5. Should productive farmlands in the greater Chicago area be converted to urban development sites?

The small groups discovered that precise, narrowly defined problem statements are central to the construction of purposeful models. The two groups which developed

problem questions #1 and #3 above had great difficulty building models which allowed them to draw conclusions because the questions are too open-ended and do not call for a solution. The other three groups found that their models both assisted the conceptualization of solutions and suggested implications for policy-making and education.

The short length of the workshop prohibited detailed incorporation of educational and policy aspects into the model building process. Yet, the model development exercise and subsequent discussion raised several educational and policy implications:

1. Development of matrices, flowcharts and feedback loop diagrams not only helps identify key components in systems and define policy alternatives, but they also represent effective methods of communicating information to the public.
2. Model building holds great promise as an instructional method to demonstrate environmental problem solving in the classroom. Models enable the instructor to portray real world environmental problems vividly and to present systems theory in concrete terms.
3. Coupling systems thinking with model-building in the learning process has a dynamic effect upon students -- clarifying relationships which make learning purposeful, revealing perspectives which allow students to assume more active direction of their academic programs, and developing analytical and communication skills applicable to many fields.
4. Model building is a methodology which has numerous field study applications outside the classroom which can lead to data useful for policymaking. As lack of data in usable form is one of the most serious obstacles to sound environmental decisionmaking, faculty and students have opportunities to make beneficial contributions through studies of actual environmental problems.
5. Systems models which are comprehensible and validated through real world verification measures almost always provide alternatives for decision-making superior to decisions based primarily upon intuition.
6. Systems analysts and educators should be more assertive in communicating the benefits of modeling to policy-makers, including the positive and negative aspects of the methodology, even though systems analysis differs from traditional decision making processes.

Evaluative comments by participants reveal the variety of needs the workshop met. The workshop did not fulfill all of its objectives, but the majority of participants felt it served four basic purposes well: (1) a valuable learning experience, (2) an excellent demonstration of useful teaching methods, (3) an effective exercise in group dynamics and problem solving, and (4) a highly satisfying form of professional fellowship. Two evaluative comments help to describe the general reaction to the workshop, "A highly successful, well-organized exercise ... it was one of the best educational experiences I have had ... It introduced me to model-building and the importance of group dynamics and formulation of problem statements." The other, from a participant who had driven 1,500 miles to attend, emphasized that the most meaningful purpose the workshop had served for him had been "getting back together with a congenial group of well-motivated, dedicated, sensitive educator-environmentalists."

The responses of participants are important testimony to the shortcomings of all too many professional meetings. The standard program fare of sessions featuring papers which are read, followed by question-and-answer periods, is often both intellectually unstimulating and professionally unsatisfying. The NAAE pre-conference workshops at Estes Park and Lake Geneva have responded to a thirst for subject matter learning, for exposure to new and effective teaching methods, and for meaningful professional collegiality. Perhaps most of all, the workshops have created an active rather than passive meeting environment. Thus, they have

achieved the ideal humanistic learning setting that environmental educators
wish to create for their students, but which they have had difficulty establishing
for themselves.

APPENDIX I

Environmental Studies 1978 NAAE Pre-Conference Workshop

"Systems Approaches in Environmental Studies"

George Williams College
Lake Geneva, Wisconsin
April 28-30, 1978

Workshop Goal: To review principles of systems thinking and systems model-building, to apply these principles to specific interests of workshop participants, and to formulate some systems objective in environmental education and environmental policy-making. The workshop will join scientists, humanists, educators, and policy analysts in seeking to deal with environmental problems in comprehensive systems terms.

Friday, April 28

3:00-6:00 P.M. Arrival and arrangements at Lake Geneva (Payment for registration, lodging, and meals; receive information packet, etc.)

6:30-7:15 P.M. Dinner

Session 7:30-9:30 P.M. Opening Workshop Session

I

- A. Introductions and orientation
- B. Workshop format and objectives
- C. Orientation lecture on Methods of Systems Model-Building
- D. Organization of workgroups

Each participant will join a specific workgroup of approximately six persons which will develop a systems model during subsequent sessions dealing with a specific environmental problem. Each workgroup will be composed of an interdisciplinary team consisting, as much as possible, of scientists, humanists, educators, and policy analysts.

9:30 P.M. Refreshments

Saturday, April 29

7:45-8:15 A.M. Breakfast

Session 8:30-10:00 A.M. Workgroups and Systems Models

II

- A. Orientation of workgroups
- B. Presentation and discussion of an illustrative systems model.

10:00-10:15 A.M. Break

Session 10:15-12:15 P.M. Systems Approaches: Problem Definition and Model Development

III

- A. Workgroups define problem, select methods, identify roles and relationships
- B. Workgroups begin model development
- C. Each workgroup designates a reporter on:
 1. Model-building process
 2. Educational aspects and implementation
 3. Policy aspects and implementation

12:15-12:45 P.M. Lunch

Session	1:30-3:00 P.M.	Systems Approaches: Model Refinement
IV	A. Workgroup sessions on refinement of models B. Workgroups evaluate educational and policy aspects and implementation of models.	
	3:00 P.M.	Break - Refreshments
Session	3:15-6:30 P.M.	Report Preparation and Open Time
V	A. Workgroups complete any unfinished activity, including format of modeling report B. Workgroup educational and policy reporters meet to prepare workshop reports C. Informal activities and free time	
	6:30-7:15 P.M.	Dinner
Session	7:30-9:30 P.M.	Workgroup Reports on Systems Models
VI	What elements and relationships have been identified which must be included in the development of models describing optimum cooperation among scientists, humanists, educators, and policymakers in assessing and implementing solutions for an environmental problem?	
<u>Sunday, April 30</u>		
	7:45-8:15 A.M.	Breakfast
Session	9:00-10:30 A.M.	Reports on Educational and Policy Aspects and Implementation
VII	How should systems approaches and the elements and relationships identified in Session VI affect environmental education and environment policy-making? How can systems models be made more comprehensive through incorporation of education and policy concerns?	
	10:30 A.M.	Break
Session	10:45-12:15 P.M.	Closing Session
VIII	A. Evaluation of workshop B. Discussion of publication options C. Plans for workshop report in Chicago D. Discussion of 1979 pre-Conference workshop E. Approval of NAAE Environmental Studies Section By-Laws	
	12:15-12:45 P.M.	Lunch
	1:30 P.M.	Bus departs for Chicago and NAAE Conference.

APPENDIX II

Model Building

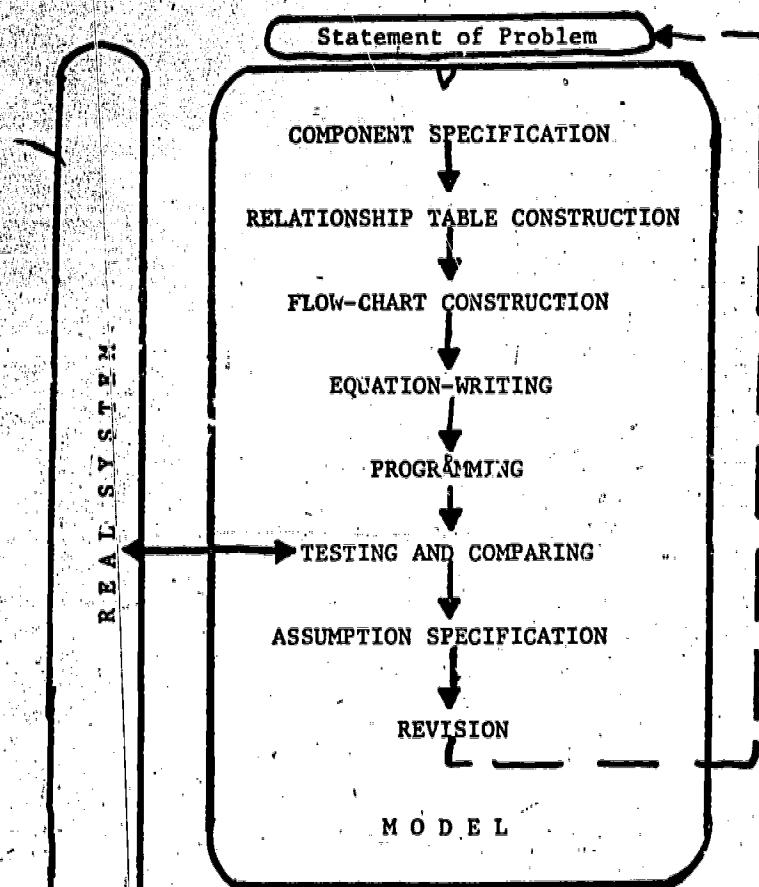


FIGURE 1.

II

POP	B	D	BR	DR

I

POPULATION
BIRTHS
DEATHS
BIRTH RATE
DEATH RATE

I IS DIRECTLY AFFECTED BY II

FIGURE 2.

THE URBAN SYSTEM AS A SOCIO-ECOLOGICAL EXPERIMENT

Lynton K. Caldwell¹

In 1967 I addressed the Urban Law Institute on "The Urban Environment as an Ecological System." I concluded my observations by saying that:-

The challenge of the second urban revolution is to the capacity of human intelligence to control the forces that human ingenuity has liberated. Thus, the focus of the ailing city must be enlarged to permit the urban crisis to be seen as an acute phase of the larger effort of our society to cope with the changes induced by twentieth century science and technology. Unless urban problems are attacked within this broader context of the total ecological system, they are not likely to be successfully resolved.²

The decade that has passed since then has brought no change in my conviction, except to reinforce it. Nor am I more hopeful that American society, as we presently know it, can cope with the continuing deterioration of the quality of urban life. There are, of course, exceptions to the downward trend, and they are generally well publicized. But local successes do not necessarily cumulate to general victory. These successes, moreover, differ markedly in cause and kind. Some may be more genuine and lasting than others, and comparative study of their bases and prospects might prove instructive. But the general picture is not bright. The nation's greatest city has had a near brush with bankruptcy and may only be living on borrowed time as well as borrowed money. The degraded condition of large areas of New York -- abandoned buildings, filthy, unsafe streets and recurring outbreaks of collective violence -- contrast surrealistically with new shining towers of glass, steel, and corporate wealth. If there is an ecological analogy to the strange juxtaposition I have not discovered it, but it suggests what some ecologists describe as a disclimax state.³

Historical perspective may lend some equanimity to the disturbing prospect. One may conjecture that the marble palaces of Imperial Rome rose above squalor, and that degraded and unsafe quarters have been found in cities, small as well as great, throughout historic time. Yet I find little comfort in this view for three reasons. The first is knowledge that these dangerous cities were often stabilized by brute and summary force; the second is that some cities have achieved periods of socio-ecological health and cultural vitality; and third, that no historical city was as complex, as vulnerable, and as hypertropic as the megalopolis of today. For example these late twentieth century cities depend for their survival upon life-support systems that are easily disrupted. Their food, fuel, water and electrical energy come from distances over which they have only the most meager control. Their internal social divisions are moreover less stable and less predictable than those of traditional societies in which class, caste and status were assumed and accepted as in the nature of things -- however much they have been resented. Not until comparatively recent times has the idea of a just society gained acceptance as a feasible goal of political action. The Augustinian De Civitate Dei (AD 426) was truly not of this world.

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²Indiana Legal Forum 1 (Spring 1969) 308-309. I owe the expression "Urban Revolution" to Gordon V. Childe, Man Makes Himself, New York: Mentor Books, 1951. The first urban revolution comprises the socioecological changes that accompanied the rise of great cities to the ancient world. The second urban revolution refers to the even greater changes associated with the industrial city of the 19th and 20th centuries.

³Peter W. G. Newman, "An Ecological Model for City Structure and Development," Ekistics 40, (October 1975), 262.

Lessons, If Any, Not Learned

After 5,000 years of experience people seem not to have learned how to build or maintain ecologically "good" cities. "Good" is of course a normative and subjective term, yet I believe that objective criteria can be found to justify the designation of some cities as "good" relative to others. The quality of urban life is a larger theme than my topic can accommodate and so I must somewhat arbitrarily summarize the essentials of a good city without defending in depth the reason for my choice.

I regard as good a city that possesses the following qualities:

SECURITY

Its people are secure in their persons and possessions from endemic or systemized threat of violence.

VITALITY

Conditions of health, physical and psychological, are as good as the technology and situation of the city permit.

SOCIABILITY

Its social atmosphere is one of tolerance, compatibility, and accommodation respectful of diversity and private choice.

CREATIVITY

Its cultural character is distinctive, reflecting a pride in the accomplishments and traditions of its people, exemplified in the commercial, civic and aesthetic arts.

PRODUCTIVITY

It is economically and intellectually productive and self-renewing, with a satisfying balance between the numbers and skills of its people and opportunity it offers for constructive work.

PROPRIETY

Its built structures and life-support systems are safe and durable, adequate to culture and climate, harmonious and efficient in their interrelationship and in relation to their natural environment.

These qualities are obviously normative and subjective. I introduce them merely to point out that although large numbers of people might agree that they were generally desirable, there would be great differences of opinion as to how, if at all, they might be implemented. And cities might be very different in character, yet technically conform to these criteria.

For quality in cities as in people is more easily recognized than defined. Quality, like health, is most easily defined by its absence, although this test falls short of adequacy. A good city is not merely free from serious social, economic, or ecological disorder. It has an elan that can be sensed, even though it may elude measurement. Yet the positive qualities of urban life are beyond analysis. A functioning city is a living system and its components do not function in isolation. A city massively deficient in any of our six qualities of goodness is almost certain to be deficient in some or all of the others.

If the qualities of good cities are widely recognized, why are not more cities "good?" Societies have seldom built or kept good cities through forethought of design. Aesthetic success has not ensured against social failure, and economic success has often been accompanied by ecological failure. The better cities seem more the result of fortuitous accident than of rational intent. The success of planned cities has often been short-lived. Much that has been learned about urban life seems to have, or to have received, little practical application. In effect, humanity has carried on experiments in urban living without criteria, controls, or agreed evaluative methods. We have therefore been unable to benefit from what might have been learned about a very common human experience.⁴

I believe that there are two principal reasons for our failure to learn from experience. The more readily apparent and relatively less important reason is lack of knowledge or technique that is basic to coping with a range of urban problems.

Ecology and the behavioral sciences are the sources of this information and they are among the youngest and least developed fields of knowledge. A more serious deterrent, however, is the obstruction of learning by beliefs inconsistent with reality. The shaping and governing of cities has been commonly based upon premises and methods that conceal rather than clarify problems. Popular beliefs about how people do or should behave have often proved contrary to behavior in reality. Jay Forrester has analyzed this phenomenon, identifying it as "the counter-intuitive behavior of social systems."⁵

These two aspects of informational deficiency are closely linked, the second restricting the first. The way in which we study a problem is influenced by the way in which the problem is perceived or defined. Accepted beliefs about human behavior and human relations largely structure our study of urban systems and tend to filter the acceptability of findings of urban research. Our beliefs have the character of psychic investments in our relationship to reality. Moreover, beliefs tend to be clustered and interrelated so that to change one significant belief may affect many others.

Underlying these obstacles to learning from experience is a third which is basic: urban systems are human systems and are thus culture-dependent and culture-governed.⁶ The complexity and irreversibility of cultural processes makes their behavior difficult to understand, to model, or to predict. The learning problem may thus be pictured as a triangle, one side of which is verified but insufficient knowledge, the other side being unverified belief, and the base of which is historical and evolving culture. It has not been demonstrated that the triangle precludes our ability to learn from urban experience, but it may help to explain why we have seldom done so.

Requisites for an Experimental Approach

The foregoing analysis suggests that we are not likely to solve our urban problems readily. It also should suggest that a "solution" would be temporal and culture-relative and that no solution is likely to be attained without costs — psycho-social, political, and ecological. It follows that a purely analytical approach to urban systems is not feasible. Abstract models may be developed for

⁴ For example, the effects of crowding and overload in inter-personal contact. Cf. Stanley Milgram, "The Experience of Living in Cities," Science, 167, (13 March, 1970), 1461-1468.

⁵ Jay Forrester, "Counterintuitive Behavior of Social Systems," Technological Forecasting and Social Change 3 (1971).

⁶ Geoffrey Vickers, "Practice and Research in Managing Human Systems -- Four Problems of Relationship," Policy Sciences 9 (1978), 1-8.

specific aspects of urban experience, and they may have an instructive although limited value. But the dynamic complexities of urban life will be most effectively approached by a complex intermixture of methods, designed, so far as possible, to cross-check one another, to more accurately define areas of ignorance, and to deal as realistically as possible with normative issues.

Productive inquiry into the viability of cities is thus problem-focused and multi-disciplinary. Academic urban studies programs have to date had little practical impact. Their products have largely been descriptions of selective urban phenomena, and they have seldom effectively related normative values to cultural, behavioral, or ecological realities. The current fashion of "advocacy scholarship" has tended to rationalize these weaknesses and to delay the development of more objective, realistic approaches to urban problems. More comprehensive, cautious and controlled approaches to urban behavior are required if the present condition of urban systems is to be better understood and possibly, by some validated criteria, improved.

Any effort to change the character of an urban system and to improve the quality of urban life must necessarily be experimental. There is really no other way that can be easily essayed. Planned change is certainly feasible within limits, but recognition of the limits is essential to the safety and success of the planning. Considered and directed control, within the limits of the feasible, appear necessary to shape the future of any urban system. The history of the rise and decline of cities illustrates the difficulty of their becoming self-directive under any but very exceptional circumstances. Sir Geoffrey Vickers identifies the difficulty when he writes that:

A system made up of sub-systems capable of representing to themselves (whether rightly or wrongly) their own position in a system, their own power to change it, and their own norms of what it should be will surely behave differently from one not so composed. It will, I think become logically impossible for it to predict its own behavior or its own future state.⁷

To test the validity of the observation one need only attempt to show how he could predict with rough accuracy the state of the cities of Chicago, New York or Los Angeles in the year 2000. What odds would a knowledgeable gambler give that the balance and the behavior of the ethnic, economic, technological and political subsystems of these cities can be predicted through the next two decades? To some extent their behaviors could be projected from past performance; but would the extrapolations be trustworthy? Experience suggests caution. The possibility of quantum leaps of hierarchical restructuring of relationships must be considered, even though it can not with assurance be predicted.⁸

General systems thinking offers the most promising approach to experiments with cities. This is because it provides the best available means for linking analysis to synthesis in a multi-disciplinary problem solving context. The basic discipline in an experimental study of urban systems would be ecology, broadly defined. This is because, with all its shortcomings, ecology comprises the most reliable body of present knowledge concerning the behavior of living systems. Yet it is insufficient as a basis for understanding human systems because of its limited applicability to cultural phenomena.

⁷"Some Implications of Systems Thinking", A Presidential Address given at the Annual General Meeting of the Society for General Systems Research in February, (1978), 13.

⁸The hierarchical restructuring concept has been developed by John R. Platt, and is also suggested by a hypothesis called "castrastrophe theory". See E.C. Zeeman, Scientific American 234, (April 1976), 65-83.

Systems methodology could help greatly in solving technical problems of urban systems if the cultural aspects of urban life were propitious, consistent and controllable. By this I mean propitious for the logic of the systems approach, consistent with respect to popular values, and controllable in relation to the implementation of those values. Unfortunately the systems approach has seldom been applied in ways that overcome the difficulties of cultural contradiction and inadequate institutions for consensus-building. Professor Jay Forrester's urban dynamics models offer one example of the way in which systems methods can enable us to experiment with cities without interference with people and property. They help to explain the failure of many of our urban policies, but they also arouse heated protest among persons who dislike Forrester's interpretation of his findings.

The "Experimental City" is another systems approach to urbanism.¹⁰ Based largely at the University of Minnesota, but with industrial collaborators, an effort has been made to apply systems thinking to the building of an actual city.

If one were to build a city today using the available scientific and technical knowledge, what would it be? Unfortunately such a city has not yet been built, although a site was selected in northwest Minnesota. A major investment of public funds in this experiment might help us obtain some practical answers about the design of contemporary urban systems. But an experimental city must ultimately confront the people problem. We can experiment with computerized models and conduct limited experiments with real urban systems but our opportunities for dealing experimentally with people are severely limited.

The Interactable Problem of Culture

I accept the possibility, but with little confidence, that human beings can deal objectively with cultural phenomena. I am less confident that they will. The costs of objectivity, assuming that it is attainable, may be greater than human society can support. These costs are not fully predictable, but they include psychological, ethical, economic, and political concessions that individual scholars might be willing to make, but that human institutions and collectivities (e.g. consumers, property-owners, production workers) ordinarily could neither make nor, beyond limits, tolerate.

It is today widely assumed that cultural differences are or can be made infinitely compatible. Particularly in the United States, efforts to break down ethnic, racial, economic, and sexual exclusiveness have been carried beyond historical precedent and have been institutionalized in public law, administrative policy, and even commercial advertising. Inter-group segregation, whether voluntary or involuntary, is widely reviewed as socially undesirable and unhealthful. Yet paradoxically, a group consciousness and solidarity is simultaneously emphasized with seeming disregard for the friction which these countervailing tendencies introduce into the urban system.

⁹ Jay Forrester, Urban Dynamics, Cambridge, Massachusetts, (1969). For a critical review of the strengths and weaknesses of Forrester's approach see K. Preston White, et al., "System Dynamics Approach to Urban Planning," Journal of the Urban Planning and Development Division, Proceedings of the American Society of Civil Engineers, Vol. 100 (March 1974), 43-56. The authors conclude: "As an accurate model of an urban system, the UDM is itself a failure. But the UDM and the commentary it has engendered have suggested the direction in which improved models may be found. To travel in this direction, we believe will require an interdisciplinary effort among experts from a wide variety of academic fields. It will require the mediating offices of generalists, trained in diverse disciplines. It will require seeking the cooperation of public officials and community representatives."

The lesson implicit in the controversy surrounding the UDM is the need for cooperation among all concerned with social problems. The promise extended is one of increased understanding of those problems through the integration of all our resources.

¹⁰ Athelstan Spilhaus, "The Experimental City," Daedalus XCVI (Fall 1967), 1129-1141.

Extensive human experience with compartmentalized systems of settlement, in which populations have been segregated on the basis of culture and largely by mutual consent, has been rejected or ignored. One need not generalize from historical experience to nevertheless observe that for long periods of time and in many parts of the world multi-ethnic cities have functioned with relatively little intergroup conflict or oppression. Ethnic segregation in the great cities of the Middle East appears to have worked well until the rise of nationalism.¹¹ Democracy as practiced, although not necessarily in principle, has often exacerbated intergroup intolerance. Traditional multi-ethnic cities such as Cairo, Constantinople, and Baghdad were governed under the authority of dynasties that exacted little from their populations beyond payment of taxes and acceptance of the dominant position of the dynasts. The ethnic sub-systems of these dynastic cities often enjoyed a relatively high degree of autonomy and self-determination short of challenging dynastic prerogatives.

Boss-ruled multi-ethnic cities in America suggest an analogy. Like a Middle Eastern potentate, the late Richard J. Daley, Mayor of Chicago, mediated over a multiplex urban system in which his Cook County Democratic organization was the only effective common denominator.¹² Is it more than coincidence that the disintegration of the political machines that governed American cities for several generations coincided with the beginning of the social and physical disintegration of these cities? Which, if either, was cause and which effect? Or were both trends the consequence of changes in technology made possible by enormous inputs of cheap energy in the forms of electricity and petroleum which permitted the mechanization of agriculture, the decentralization of industry and housing and the exponential increase in personal mobility through the automobile? Whatever the explanation, portentous changes were introduced into 20th Century American cities with almost no regard to their consequences and implications. Similarly the introduction of Western technology, medicine, and investment in Third World countries has led to cancerous growth in their greater urban centers which have become sinks for poverty, unemployment, crime, dependency, and political unrest.

Urbanization has become a world-wide phenomenon and urban problems have been prominent on the agendas of international organizations and conferences. But benefits have not been impressive, to date. The most ambitious effort has been the United Nations Conference on Human Settlements (Habitat).

Unlike the 1972 United Nations Conference on the Human Environment, the 1976 U.N. Habitat Conference produced little tangible result.¹³ The reasons are several, but high among them may be that the Environmental conference was primarily concerned with man's relationship to nature and thus could rely to some extent upon a verifiable information base in the natural sciences, whereas Habitat dealt primarily with people-to-people relationships in which verified data were weak but ideological and cultural biases were strong.

Thus, while experts confer the cities decline. The project of urban revitalization is not bright. Symbolic gestures and pseudo-renewal are essentially cosmetic and temporizing. The holding power of Peachtree and Renaissance centers is uncertain. What does seem certain is that the great urban systems are becoming increasingly hypertrophic, unstable, vulnerable to disruption, and metastasizing throughout the national economy. The socio-ecological collapse of one or more great centers such as New York or Chicago could conceivably carry a large part of the rest of the country into ruin.

¹¹ Carelton Coon, Caravan: The Story of the Middle East, New York, 1951.

¹² Cf. Evans & Novak, "Mayor Daley is being missed in Chicago," Field Newspaper Syndicate, (24 March 1978).

¹³ Report of Habitat: United Nations Conference on Human Settlements, Vancouver, 31 May - 11 June 1976 (A/CONF 70/15); "The Role of the United Nations and the Specialized Agencies in Human Settlements," Human Settlements: Vol. VI (No. X, Special Habitat-Issue, May 1976) and Vol. VII (Nos. 1 & 2, January/April 1977); "Habitat," UNESCO Courier 29th year (whole issue, June 1976). Also see Mohammad A. Qadeer, "The Futility of World Conferences," International Development Review 19 (No. 1, 1977), 13-15.

The qualities of a good city that I have enumerated may have emerged in particular times and places without apparent design or plan. But it seems improbable that they would have emerged wholly unwanted or unvalued. In this world there are more wrong answers than right answers to any problem. A will to survive and a sense of latent danger would appear to have been attributes necessary for urban communities to persist through the vicissitudes of time. But the circumstances of historic man may have kept him in closer touch with ecological realities than his present-day successors. The Roman citizen or medieval burgher probably understood the workings of his life support systems and their vulnerabilities better than do the air-conditioned masses of the modern electronic age. Thus the culture of contemporary man may disarm him against the greatest threat to his survival which is his vulnerability to unforeseen errors of his own making.

The Technological Basis of Systems Change

Technology dynamically links physical and cultural systems. Reciprocal interactions among these systems, their subsets, and the natural environment, if manageable, can only be safely managed through a holistic overview. This overview or perspective should not be confused with comprehensive social or environmental planning or management. It is much less, although possibly more extensive in its scope than most so-called comprehensive planning that occurs today. The need for holistic overview rests upon the assumption that we can see more than we can act upon, but through scanning and surveying the field of action the more promising routes to our objectives may be discerned and the more probable hazards identified. The Urban Observatory program initiated in 1969 by the Department of Housing and Urban Development and the National League of Cities has been an attempt to provide timely and relevant data on urban trends and conditions.¹⁴ It has brought universities and public officials into cooperative institutionalized study of urban problems. The number of cities involved is small but the experiment may point the way to a wider use of investigative techniques in monitoring the condition of cities.

Throughout historic time human society has, in effect, experimented with technology but without the benefit of forecasts, monitors or controls. Technological ingenuity aided by science has vastly and swiftly extended the scope of human action without significantly increasing those aspects of culture by means of which this action could be contained and controlled for the lasting benefit of mankind. Only now are means being sought to foresee the ramifications of applied technology and to forestall unwanted consequences. Two familiar examples are environmental impact analysis and technology assessment. Yet timely and appropriate action does not necessarily follow foresight. The appreciative and evaluative aspect of culture will inevitably influence the uses man makes of knowledge.

Without a degree of value consensus and concern sufficient to enable a critical mass of population to agree upon the general direction of its preferred future, the technology of our times assumes more and more the character of a "free force," with the ominous implications described by Jacque Ellul and conjectured in science fiction.¹⁵

Technology does not yet direct itself and its manipulator is still human. Fatal misuse of technology would be self-destruction, and eventualty of increasing probability as the growing power of technology continues to exceed social wisdom and fails to address the growing vulnerability of human society.

¹⁴ Lawrence A. Williams, "The Urban Observatory Program: A HUD-Funded-City University Experiment that Works," Nation's Cities 12 (December 1974), 25-40.

¹⁵ The Technological Society, Translated by J. Wilkinson, New York (1964).

Experiments with nuclear energy, exotic chemicals, and recombinant DNA, entailing risks real or imagined, are now subject to controls to minimize the likelihood of unwanted consequences. Yet society proceeds with gross socio-ecological experiments with minimal consideration of risk. Techniques of automation, communication, transportation, housing, education and medical care have been introduced, promised, and promoted with no real knowledge of where they might lead and how they might interact. Our urban systems, and indeed whole societies, have become laboratories for experimentation without testing, safeguards, monitors or controls. To extend the benefits of science and technology to our urban systems we must experiment, for we have no way of arriving at a priori judgment that can be relied upon to predict how innovations will perform in the real world. What our safety and survival require is systematic control over this experimentation, and to obtain that will, in turn, require changes in our attitudes, laws and institutions that we have not yet shown our capacity to make. Is this the Toynbee-esque challenge to which our civilization must respond in order to survive?

We are not without guidance toward what we need to learn and how we might experiment in advancing our ability to create and maintain viable cities. Under a grant from the National Science Foundation, The Institute of Ecology undertook an extensive study of urban ecosystems and reported a large number of recommendations for research and action.¹⁶ The Report attempts "to highlight and clarify the principles underlying the urban system function" and represents a comprehensive interdisciplinary approach to urban studies.

Whether the Urban Ecosystems study gives us a feasible blueprint for action is, however, dubious. The social and behavioral aspects of the Report evidence the same assumptions and perceptions that I see as frustrating and realistic strategy for resolving urban disorders and conflicts. The Report does not deal realistically with the intractable problems of culture and perceived self-interest. Nevertheless there is much that it recommends that might lead indirectly to a more practical view of these problems.

Urbanism therefore is a continuing experiment in which there is some hope that knowledge may be advanced to serve wisdom in action. But the road toward this goal is neither direct nor clearly marked; and if we understood how to create cities that we would agree were truly good, we would have found many of the answers to the ills that have afflicted human societies.

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¹⁶ The Urban Ecosystem: A Holistic Approach, edited by Forest Stearns and Tom Montag, Stroudsburg, Pennsylvania: Dowden, Hutchinson and Ross, 1974, 217.

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ENVIRONMENTAL CONTROL IN CITY GOVERNMENT

H. Wallace Poston¹

The City of Chicago has long been an advocate of environmental control at the local level. Its history of legislation attests to this fact. As far back as 1881, the City Council adopted one of the first anti-smoke ordinances in the nation containing fines for violations and as early as 1907 a Department of Smoke Abatement was established.

By 1962 open burning had been banned in the city and an historical record of the levels of sulfur dioxide and suspended particulates dates back to 1964. Vast improvements can be noted by examining these data. To further refine monitoring the city pioneered one of the first telemetry monitoring systems in the nation, setting up an eight-station network which reported pollution data continuously.

To preserve the quality of Lake Michigan as a source of drinking water to keep its aquatic life intact and to provide a continued recreational spa for swimmers, the city, in 1967, passed an ordinance requiring retention tanks on recreational vessels with heads and galleys. It further required that diversion valves be sealed and that wastes be disposed of only at pump-out facilities located in harbors.

By 1970, environmental concerns had peaked and the city established a Department of Environmental Control to abate and regulate not only air pollution, but noise pollution, industrial waste water discharges, sanitary landfill operations and solid waste disposal.

At this time the burning of high sulfur coal and oil was limited to one percent outmoded incinerators outlawed, and leaf burning banned. The effects of these restrictions brought about a rapid improvement in air quality especially for sulfur dioxide and more gradually for suspended particulates. Since the enactment of these ordinances in 1970, levels of sulfur dioxide dropped 63 percent, now meeting both primary and secondary federal air quality standards. Suspended particulate levels also fell off steadily and now close to 60 percent of the city meets the federal standard for this pollutant whereas, in 1970 no area of the city was in compliance. The effects of these regulations are still evidenced in improved air quality.

A joint report released by Argonne National Laboratory and the University of Chicago in 1974 credited the low sulfur ban with an annual savings of \$23 million in personal and household cleaning costs and medical bills.

In other areas Chicago was a leader. In 1971 phosphates in detergents were limited and ultimately banned. After a lengthy court battle with Proctor & Gamble and FMC Corporation, Chicago's ordinance was upheld. The phosphate ban has proved successful. Nowhere is this more evident than at the Metropolitan Sanitary District's west-southwest plant where since 1971 there has been an average 84 percent decline in the treated effluent. The effluent concentration is well below the Illinois standard of one milligram per liter for the Lake Michigan basin area and the Fox River basin. Taxpayers have also benefited because costly treatment plant construction was not necessary as phosphates were removed at the source.

In noise control the city has led the nation. Its 1971 ordinance, an outgrowth of earlier legislation, established decibel limits on major urban noise sources, particularly on motor vehicles, the dominant noise source. Vehicles are now required to meet different noise levels at speeds under and over 35 miles per hour. Traffic is monitored by a noise team using noise meters and police officers apprehend violators.

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In 1971 there were 248 public schools in the city which were major local sources of pollution from coal burning. The Board of Education estimated at that time that unless funds were available to convert to gas the project would take 20 years. Within the same year, Illinois House Bill 2466 was passed approving \$250 million for a school rehabilitation and modernization program. Equipment had to be 20 years old to qualify. Eighty-one percent of the boiler heating plants in the schools were 34 to 37 years old. Seventy-one percent were still being hand fired.

By the end of 1976 all of the schools had converted to gas, eliminating nearly 5,000 tons of fly ash and other pollutants associated with coal burning. A compliance timetable established by the department's Appeal Board kept tab of the progress made by the schools.

In other procedures to eliminate pollution the department began in late 1976 to inspect service stations and other facilities that store and dispense petroleum products. The potential vapor loss when gasoline is transferred from the tank truck to the service station storage tank had been estimated by department engineers at some 6,500 tons of hydrocarbons per year. Some 3,000 facilities are inspected yearly.

In conservation matters, several industries in Chicago have installed pollution control recovery systems which have served a dual purpose; reducing emissions to the atmosphere and at the same time recycling wastes into reusable by-products. Generally these systems have paid for themselves and at the same time conserved fuel used in the process.

The city's own supplemental fuel project picks metals out of refuse and shreds combustible by-products which are used by Commonwealth Edison to generate electricity.

In general it has been the policy of the city to take preventative measures, to conserve energy, and to encourage industry to make capital investments for processes which eliminate pollution and recapture by-products.

THE ROLE OF URBAN ENVIRONMENTALIST — A MODEL

Daniel Swartzman¹

INTRODUCTION

In this paper, I wish to present a model (see Figure 1) which represents the urban environmental system. I will discuss some of the components of this system (substantive environmental problems and sociopolitical processes), their interactions and the context in which they occur. My thesis is that to understand the role of the environmental public interest advocate, we must understand the arena in which he or she operates.

BACKGROUND

The role of the public interest advocate in the emergence of this country's environmental consciousness has been long and bright. It was the patient work of the turn-of-the-century naturalists and conservationists which laid the foundation for all of today's environmental protection laws. Throughout the first sixty years of this century these groups studied and enjoyed our natural environment. As our industrial society grew and as our unplanned use of the earth's natural resources increased exponentially, they were the first to sense a danger. This feeling mounted into the sense of extreme urgency which gave rise to the massive environmental public interest movement of the late sixties and early seventies.

On Earth Day in 1970, the environmental movement became an American institution. The National Environmental Policy Act had made the environment a subject for examination in all major federal decisions. By Executive Order, the Environmental Protection Agency was given life. The passage of the Federal Clean Air Amendments in 1970 and the Federal Water Quality Control Act in 1972 gave this new Agency a clear mandate and the strength to carry it out. Built into this government action was citizen access and review.

Increasingly, more of the decisive action taken by public interest groups was executed by professional environmental advocates, occupying jobs in a field that did not even exist a decade earlier. While the concerned private citizen played a paramount role in providing grassroots muscle to affect government decisions, the exceedingly complex laws and regulations were more easily the tools of the full-time professional.

And these professional environmentalists have recognized significant gains under these new acts. However, this young profession which was once almost a religion has become a political, bureaucratic institution. The highly motivated and concerned private crusader has been supplemented and, unfortunately, to some extent replaced by the trained and skilled professional, often a specialist in one area of environmental protection. While the current need for the concerned individual must not be underestimated, we should acknowledge the creation of this new occupation and its role in America's pluralistic system.

Now that those of us who make their living as environmental advocates have become part of "the system," it behooves us to examine who we are and what roles we play. We can best do that by understanding the system in which we work and the place that system occupies in U.S. society.

COMPONENTS OF THE MODEL

The model of the urban environmental management that I offer in this presentation is an attempt to specify the components of the system and to represent their interactions with each other and with other elements of urban life. Throughout this discussion I will try to use examples drawn from Chicago's experiences, although I believe the model could be generalized to any urban environment.

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URBAN ENVIRONMENTAL SYSTEM

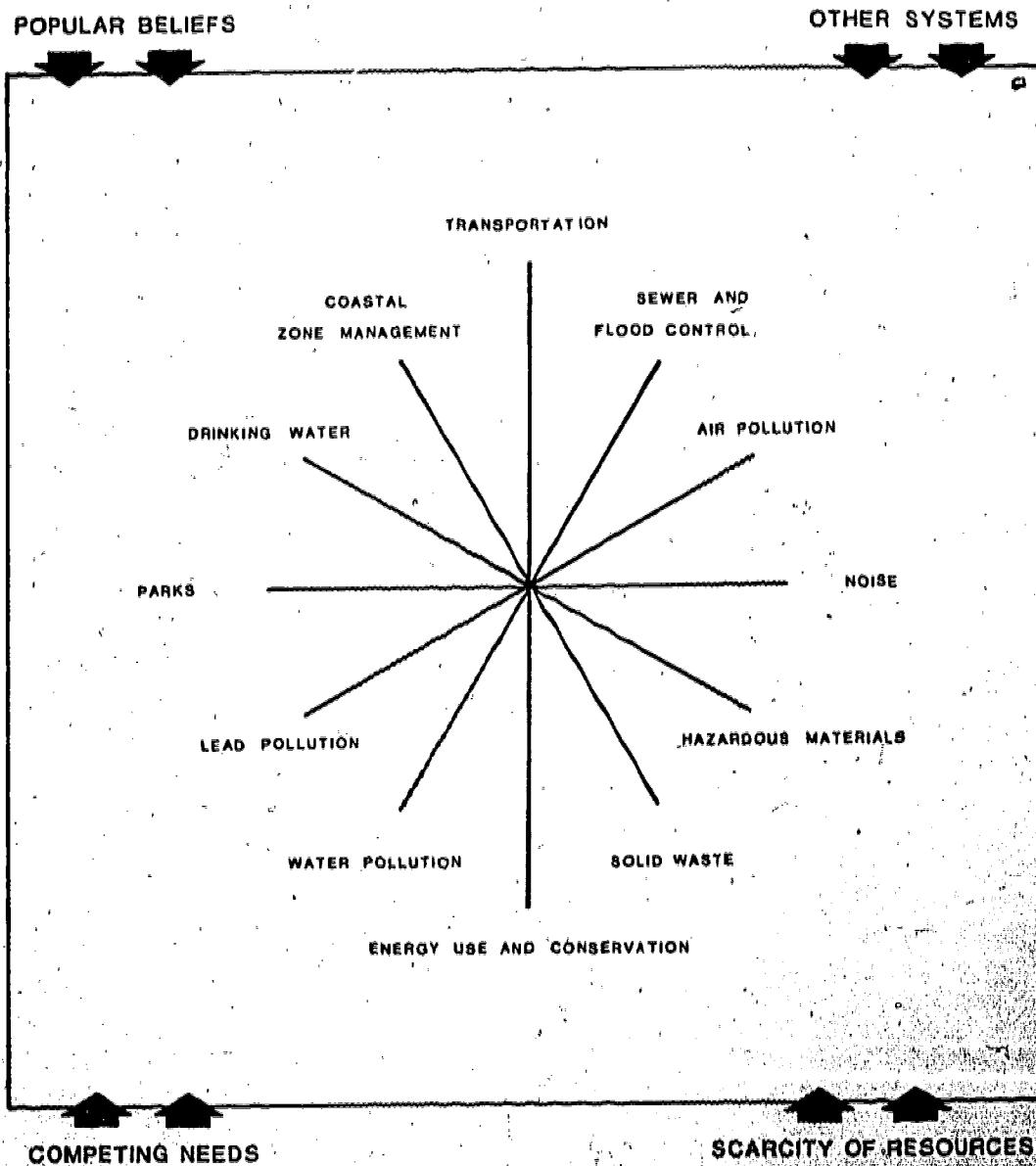


Figure 1. Urban environmental system model

A. Environmental Problems

The most well-defined components of this system are environmental problems. These are the substantive issues which make the newspapers and are the major topics of courses in environmental protection. They are most well understood because they are the most tangible, most thoroughly studied elements. They are the problems which impact our daily lives and make living in a city the negative experience it sometimes is.

For this presentation, I have identified eleven such problems which face Chicago. This list is meant to be illustrative, not exhaustive: 1) transportation, 2) energy use and conservation, 3) air pollution, 4) hazardous materials and solid waste, 5) noise, 6) sewer and flood control, 7) parks and open space, 8) water pollution, 9) coastal zone management, 10) drinking water supply and contamination, and 11) lead pollution.

- 1) Transportation - Chicago's streets and highways are clogged; Chicago's commuter railroads are going broke; Chicago's mass transit system is eighty years old. The creation of expressway and commuter train corridors have channeled the middle class and much commerce out of the city, eroding the city's tax base and making government's job tougher by lowering available funds.
- 2) Energy use and conservation - The heavy reliance on the automobile creates an energy use problem. Efforts at conservation have been minimal. The city relies on an energy system that either creates air pollution and scarred land (coal-fired boilers), or gobbles up scarce and costly resources (oil), or creates an environmental management nightmare (nuclear).
- 3) Air pollution - Air pollution from automobiles is exacerbated by contamination of electrical energy production and by the many industrial processes located in the area.
- 4) Hazardous materials and solid waste - These processes, and the increasingly important production of nuclear wastes, create a significant environmental risk from the transportation and disposal of hazardous materials, much of which is transported over heavily traveled thoroughfares in or near highly populated areas. Much of the industrial waste is disposed of without benefit of government sanction. This is compounded by difficulty in developing adequate methods for disposal of solid wastes.
- 5) Noise - The central business district produces noise at levels above those considered safe in industry. Residents near O'Hare International Airport know very well the problems of noise pollution. The problem may become more acute should supersonic transports be given access to O'Hare as has been suggested.
- 6) Sewer and flood control - The Metropolitan Sanitary District has spent hundreds of millions of dollars on the first few steps of a massive sewage and flood control program known as the Tunnel and Reservoir Project, often referred to as the Deep Tunnel. The project has been opposed by some environmentalists who consider it to be too disruptive and overly centralized. Others have supported it for its promised ability to forestall pollution of Lake Michigan from stormwater run-off. All agree the multi-billion dollar project is expensive. Funding for the program is now highly in doubt.

- 7) Parks and open space - Chicago, City in a Garden, is proud of its parks and forest preserve system. However, improvement is possible and attempts to "develop" much of the city's open space are made regularly.
- 8) Water pollution - The Lake is in the midst of a strong come-back, thanks to pollution controls and the vigilance of environmentalists and government. But the job is far from complete, and even if possible, the city's rivers are decades away from being fishable or swimmable.
- 9) Coastal zone management - The city also prides itself on the management of its lakefront, but no regulatory protection currently exists to prevent a change in the city fathers' treatment of the coastal zone, nor is there a coherent, coordinated strategy for improving our use of this resource.
- 10) Drinking water - The supply of drinking water for Chicago's suburbs is threatened by a lowering water table. Talk of diverting more Lake Michigan water to overcome this problem raises fears of environmentalists and of our neighbors with whom we share the lake. Although there is no evidence of contamination of the area's water supply, some fear that asbestos levels are already dangerously high, and continued reliance on nitrogen-based artificial fertilizers increases the risks of nitrate and nitrite pollution. Radiat problems may also exist.
- 11) Lead pollution - Lead pollution threatens the city's children, particularly those of the inner-city minority population who live in close proximity to the sources of this problem, the automobile and industrial processes.

It is important to note how difficult it is to talk about one problem without overlapping others. These issues are interrelated to a high degree and in a complex fashion. Transportation, the automobile, the use of water resources, energy production and use are all intertwined in the urban environmental mix. To the extent that the graphic depiction of the model is unable to show this, it is inadequate.

B. Sociopolitical Processes

The second component of this model is a group of sociopolitical processes. These processes or forces are not easily defined, nor is it obvious when any specific process is acting upon any particular situation under examination. Even when a process is observed as affecting the situation, it is often difficult to define the scope or magnitude of its impact.

Nevertheless, these interactions between people, ideas, interests and institutions play a crucial role in urban environmental management. To illustrate this role, six of the most important forces are presented in the schematic model. These forces are: 1) Decision-making, 2) Politics, 3) Planning, 4) Competition, 5) Transformation, and 6) Education.

- 1) Decision-making - The decision-making process is evident in many areas of the urban environmental management system. Individuals make decisions on whether to live in an urban area, where to live within the area, how much their automobile will have to be used, what environmental causes should be supported, and a host of other issues. Corporations make

siting decisions and decisions on how (or whether) to meet environmental regulations. The formation of public opinion is a complex decision-making process. Government must make decisions in the courts, in the executive agencies and in the legislature. All of these decisions will affect perceptions of the substantive problem, the weight given to the need to act, the choice of the method of solving the problem and the success of the solution.

- 2) **Politics** - A pervasive force in urban environmental management is politics. The organized politics of Chicago's Regular Democratic Organization, the Independent Voters of Illinois, the Independent Precinct Organization and the Republican Party will often dictate which problems will be addressed and how. Politics at the neighborhood level, through community organizations (like The Woodlawn Organization and the Christian Action Ministry), and through political organizing groups (like Citizens for a Better Environment, the Illinois Environmental Council, and the Illinois Public Action Council) will determine which problems have active support, and how effective these constituencies will be.
- 3) **Planning** - Chicago is a city with many planners. Northeastern Illinois Planning Commission is the official body, but the business community, Northwestern University, University of Illinois - Circle Campus and University of Chicago faculties, and a number of public interest groups like the Metropolitan Housing and Planning Council are engaged in planning activities. Their recommendations, and the all-too-infrequent implementation of their ideas, are a force which acts upon Chicago's environment.
- 4) **Competition** - In our pluralistic, free enterprise society, competition is an ever-present force. Competition among industries affects corporate decisions on pollution control; government agencies compete for shares of the executive budget; and environmental groups compete for limited access to media and for public support.
- 5) **Transformation** - Chicago has been analyzed as a city undergoing a process of transformation; it has been argued that to fully understand the city's culture, geography and economics, one must understand this process. Population size and demographics ebb and flow. Transportation patterns evolve and residents shift. The affluent areas decay and the blighted areas are reborn. The transformation of the city can be identified in retrospect and even predicted to some degree. As the city changes, forces are exerted upon the urban environment and its management which are sometimes subtle, sometimes grotesque.
- 6) **Education** - Public schools instill political values and the social value of competition and politics. Higher education trains the planners. Community education affects public opinion and other decision-making processes. As city-dwellers learn, improve, and become more environmentally aware, they are better able to interact with their city and participate in its transformation.

Again, it is readily apparent that the schematic representation of the model does not do justice to the complex interaction of these forces. They play upon each other and, in always changing combinations, upon the problem areas discussed earlier.

C. Contexts

Finally, to analyze adequately the urban environment system, one has to understand the contexts in which we find the substantive issues and the sociopolitical processes. For illustrative purposes, three contexts have been selected for consideration: 1) Competing needs and scarcity of resources, 2) Popular belief structure, and 3) Other systems.

- 1) Competing needs and scarcity of resources - The urban environment must be viewed in the context of urban life. One characteristic of urban life is the interplay between competing needs and a scarcity of resources. The environmental management system is affected by both of these and can sometimes get caught in the middle. Urban needs include a strong economic base, jobs for the city's citizens, sufficient and adequate housing, recreational opportunities, and many others. The people and their leaders try to accommodate these needs in the face of limited capital, overused land area and other scarce resources.
- 2) Popular belief structure - To understand how the processes in the urban system act upon environmental problems, the popular belief structure of the city must be recognized. Familiarity with the religious beliefs of the citizenry, the cultural life of the city and the social attitudes of the inhabitants is crucial to this understanding. An otherwise inexplicable problem could become clear if viewed in the context of racial attitudes, or prevailing religious or ethnic doctrine.
- 3) Other systems - It is also important to keep in mind that other urban systems are operating within the same time and space as environmental protection. These might include, the criminal justice system, the delivery of health care, promotion of commerce and industry, and many others.

All of these contexts form the fabric of the urban setting in which our environmental management system operates. They provide a backdrop of many interlocking and coexistent attributes. The accompanying figure simplistically represents them as outside the system which does not truly represent the intimate interrelationships that actually exist.

DISCUSSION

What then is the import of this model in understanding the role of the public interest environmental advocate? Success in public interest advocacy can be enhanced by analyzing specific problems, tasks or projects in light of their place within this system. Of course, environmentalists will never be able to identify all of the pertinent components of the system or their interactions. But to the extent that this can be done, the advocate increases his or her ability to effect change.

This change will result from manipulation of the system. For instance, by understanding the interrelationship between air pollution, energy use and transportation, environmentalists can direct their energy to reduce air pollution by breaking this linkage or by promoting less polluting transportation and energy usage. By identifying the fact that politics and competition aggravate our air pollution problem while education is relatively ineffectively used, environmentalists can direct their efforts to create a political counterbalance, building into regulations competitive incentives and increasing public education.

The obviousness of such an approach shows that common sense leads the advocate to some implicit understanding of these interactions. But as the relationships grow in complexity, common sense becomes inadequate and a more rigorous analysis

is warranted. A good example of a highly complex issue not yielding to a cursory analysis is photochemical oxidant pollution. It is both an automobile-and an industry-generated problem. We know only a little about its formation, but solution of the problem is tangled in a confounding web of politics, personal, corporate and governmental decision-making, the transformation of Chicago, and a lack of good education. It has been argued that auto controls cost too much, cause unemployment and result in less energy efficiency. The advocate runs directly into the competing needs of the citizens and also has to handle this interaction with another substantive problem. Solving this puzzle can not rely on common sense, and environmentalists who push for a particular resolution without a thorough analysis do themselves and the public a disservice. As the role of the public interest environmentalist becomes more institutionalized, it becomes more important for the advocate to understand the spots on the cards and the rules of the game. An analysis of urban environmental protection consistent with the model presented will allow the environmentalist to describe, understand, predict and control the system.

Describing the system involves identifying the relevant components and contexts. Understanding will come from delineating the interactions in scope and in magnitude. This will also help develop possible remedial programs. The advocate can then make a sophisticated prediction as to the efficacy of alternative, proposed actions. Finally, the urban environmentalist will be in a position to control the management and protection of the city's environment by changing the interactions, breaking linkages, encouraging helpful processes, by making the system work for, not against, the public interest.

URBAN ENVIRONMENTALISM: SHIFTING GOALS AND MEANS

Allan Schnaiberg¹

These remarks are perhaps most appropriately delivered on May 1st -- May Day -- a day set aside for recognition of the role of labor as a core element of socialist society. While this might have been an incidental observation during Earth Day some eight years ago, it is an important element of the movement that will be producing Sun Day later this month.

Put most bluntly, the "environmental movement" has changed since the 1960's; it has not lost its concern for the ecological structure in which the society is imbedded, but it has, rather, gained some new concerns for the nature of the society itself. These new concerns, and the problems and challenges they offer us, are nowhere more evident than in the urban sector of American society, for reasons that will be detailed shortly.

The major shift from Earth Day and the 1960's social movement around environmental issues is a concern for social welfare, as well as for that diffuse concept of "environmental protection." While the 1960's might well be characterized as a period in which the movement focussed on the costs of environmental degradation, the 1970's have seen a renewed concern for the costs of environmental reforms or protection. Most uncomfortably, this also implies a concern for the benefits of environmental degradation for industrial society, and the potential loss of many of these benefits through programs of environmental control. However, the more optimistic side of this shift is that it entails a rising concern for the actual and potential victims of unjust and socially pernicious environmental reform legislation and enforcement. Among the most advanced groups in the movement, then, there has been an integration of concerns, a duality of socio-economic and ecological welfare.

Such an emphasis on the costs of environmental reform are particularly evident within the urban stratum of this society, and especially in the older, larger cities of the northeast and midwest. These agglomerations are typically plagued with high unemployment, high levels of poverty, gross deterioration of man-made environments, and severely strained municipal budgets. Typically, this makes for maximal resistance to any program of environmental protection which entails decreased employment, increased costs of living for consumers, reduction of housing stock or slowing of its growth, or increased municipal expenditures or losses of tax revenue. As such, this provides maximal resistance for many environmental protection programs -- air and water pollution abatement, for example -- and provides nightmares for environmental activists and enforcement agencies alike.

Yet there is another side of this "anti-environmentalism" of the cities. This complex of social problems of the older cities represents an opportunity as well as an obstacle. For the social needs of these areas may perhaps be better satisfied by creative applications of "old" technologies -- what has become known as "intermediate technology" or "alternative technology" in the post-Schumacher period. As Gunnar Myrdal (in his Asian Drama) noted for the capital-poor but labor-rich underdeveloped countries in the 1960's, what large American cities need most is a higher-labor and lower-capital technology. Under the proper sets of incentives and disincentives, moreover, such forms of production may be far more environmentally benign than is the "high-technology" path of the Sunbelt cities of contemporary America. They offer the potential for substantially lower levels of energy usage per unit of social welfare (whether measured in jobs or income), as well as the potential for lower-risk air and water emissions in the urban area. Note that I stress the potential of such outcomes, and not the assurance that these outcomes will occur. Neither the market nor the current mixture of governmental controls are likely to channel investment and tax dollars along these lines, though we have examples of such policies already, in urban roof gardening, mass transit aid, solar heat for tenement structures, and neighborhood conservation subsidies.

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For such shifts in the nature of structural supports for a dual socioeconomic and ecological welfare policy to occur, a variety of shifts in the environmental movement is necessary. Groups will need to incorporate new skills, forge new sociopolitical alliances, and take systematic account of both social and environmental implications of environmental protection and energy policies. This is a goal that will not be easily arrived at in the somewhat "elitist" environmental movement. The suspicions and hostilities of the urban poor and organized labor towards environmentalists, which have become exacerbated during recent years in the confrontation between "jobs" and "the environment", are not groundless, after all. For in their zeal to "save the environment", the movement has often forgotten to ask two fundamental questions: (1) save it for whom?, and (2) who is to pay the costs of such salvation? Indeed, at times it seems that environmentalists fall into the class of people who "love humanity in general, but hate people in particular," at least industrial workers and the marginal and impoverished labor force. Industrialists have seized this opportunity to provide a mixture of promises and threats to entice the support of such groups, and they have been rather successful. The sooner energy-environmental policy groups begin to address these constituencies, the greater the potential for reorganization of production in the cities along socially progressive and ecologically saner grounds. Amory Lovins' "soft path" of energy use will, however, only transpire after a rather "hard path" of social and political conflict occurs, if at all. Small-scale local capitalists, unskilled and semi-skilled workers, and, in the far distant future, organized labor may and must be mobilized along this harder path. When this becomes an unshakable part of the environmentalist-energy agenda, we will have begun the social transformation of urban production.

ENVIRONMENTAL STUDIES

The Environmental Studies section consists of six essays which offer conceptions of the "ideal" undergraduate program in environmental studies, describe existing undergraduate and graduate programs in the field, and define the love-hate relationship that characterizes the interconnection of interdisciplinary instruction and interdisciplinary research.

The first four essays by C. Davis, R. Frey, A. Sacks, and J. Schultz represent the views articulated by the participants at a symposium conducted at the 1978 NAEE Conference at Chicago. The symposium, moderated by P. Mehne whose remarks introduce these essays, attempted to treat a broad range of questions concerning appropriate structures and content orientations for environmental studies programs. Although similarities thread their way through the essays, a unanimity of opinion is lacking. The following essay by C. Schoenfeld and J. Disinger shifts from what could or should be to what is the state-of-the-art in environmental education programs on college and university campuses across the country. Finally, J. Jondrow and J. Clapp detail the complex educational problems involving the coordination of large interdisciplinary research projects and graduate instruction. They explain five types of "mismatches" that often occur as graduate students attempt to complete degree programs while participating on large interdisciplinary research projects funded by outside agencies.

COORDINATION OF UNDERGRADUATE AND GRADUATE ENVIRONMENTAL STUDIES PROGRAMS

Paul R. Mehne¹

The following four papers were presented as part of a symposium on undergraduate and graduate environmental studies programs. This symposium investigated student and program characteristics that may enhance undergraduate and graduate environmental studies education. Participants were asked to present a brief position statement that addressed the following questions from the perspectives of their own programs:

1. What should be the program content and evaluation standards of environmental studies programs?
2. What characteristics should graduates of such programs possess? What should graduates know and be able to do?
3. What is the most effective undergraduate preparation for graduate environmental studies programs?
4. Do undergraduate majors in environmental studies make sense?
5. What opportunities exist for undergraduate-graduate cooperation?
6. What are the realistic placement opportunities for environmental studies graduates?

Discussion among panelists and audience members emphasized the need for disciplinary depth and interdisciplinary breadth in undergraduate programs (both for professional function and articulation with graduate programs).

Participants agreed that environmental studies programs should train students to be effective problem solvers. Students should be provided with the opportunity to practice skills: determining what strategies should be employed to solve specific environmental problems. Some participants and audience members stressed the importance of a disciplinary background from which students could contribute possible solutions to complex problems addressed by interdisciplinary teams. This disciplinary strength, broadly conceived, was also cited as an important vehicle through which students could market their professional skills to potential employers.

Craig Davis addressed these points quite succinctly: "A firm disciplinary background serves as a 'conceptual tree' upon which new knowledge may be hung, a reference point to which concepts from other disciplines may be related, and a base from which more abstract, interdisciplinary ideas may be investigated."

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INTERDISCIPLINARY, PROBLEM-FOCUSED ENVIRONMENTAL STUDIES

Craig B. Davis¹

The purpose of this paper is to address the question of substantive programmatic guidelines for undergraduate environmental studies. Before I can effectively present my ideas on this subject, however, I would like to further define the topic and offer some general comments on the field of environmental studies.

Definitions - The title, "Environmental" is currently being applied freely to several different types of academic programs. Prominent examples are environmental science, environmental engineering, environmental design, environmental education, and environmental studies. As a general rule, the emphasis that a particular program provides is at least somewhat indicated by the second word in the title.

- a. Environmental Science largely is a disciplinary or multi-disciplinary approach to the scientific and technical aspects of manipulating, modifying, or preserving our natural environment. Emphasis is generally placed on the physical sciences, on the ecologically-oriented biological sciences, on engineering and on statistical and computer modeling.
- b. Environmental engineering is a title that is usually used to describe programs emphasizing the use of engineering concepts and methodologies in the design of structures, equipment, and systems that interface with or attempt to describe our environment. Environmental engineering is also used as a title for sanitary engineering programs.
- c. Environmental design generally is used to describe programs emphasizing the use of concepts and methodologies from architecture, landscape architecture, applied art, and certain social sciences in the design of environmentally-sound structures, furnishing, and living systems. Occasionally, however, environmental design is used to describe programs of broader, less-obvious environmental import, such as the fine arts, dance, music, and literature.
- d. Environmental education is a broad designation used to describe programs dealing with the dissemination of knowledge about our environment and our impact upon it. Environmental education is primarily "delivery oriented". Content is, for the most part, taken as a "given" and emphasis is placed on developing effective methods and vehicles for presenting this content to school students and the general public.
- e. Environmental studies is an interdisciplinary, largely problem-focused approach to studying the nature and dynamics of our interaction with our natural/social environment. Environmental studies is strongly content oriented. Emphasis is on the quest for knowledge about and understanding of environmental systems and of the interactions between these systems and mankind's social and cultural systems.

I should note that overlap between these approaches does exist and tends to obscure the distinctions noted here. These distinctions, however, are real and must be recognized whenever the nature of one or another approach is considered. My further comments, therefore, relate to programs that fall broadly under the category of environmental studies as described above.

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Conceptual Base - An important implication of my definition of environmental studies is that environmental studies is more than a series of instructional programs for training undergraduate and graduate students. It is also a field of scholarly pursuit. Faculty members engaged in environmental studies are, for the most part, keenly interested in examining the body of knowledge, sifting it, resorting it, and examining it again with the hope and expectation that their efforts will shed some light on the interrelationship of Man, culture, society and the environment. It is this pursuit of knowledge that is the true raison d'être for the field of environmental studies. It provides the substantive conceptual base on which instructional programs can be developed.

I therefore suggest that one of the basic guidelines for any environmental studies program should be that faculty members should be actively involved in research and/or scholarly activity on topics of environmental import, and that these activities should be encouraged and supported by college and university administrations.

GUIDELINES FOR ENVIRONMENTAL STUDIES INSTRUCTIONAL PROGRAMS

When setting guidelines for instructional programs in environmental studies, the most important consideration is, of course, the nature of the product we hope to produce. What should our students be when they leave our programs? What skills should they have? What insights should they have gained?

In my opinion, our principal goal in our instructional programs should be the production of effective environmental problem solvers. The magnitude, complexity, and immediacy of the environmental problems facing us today are obvious. The problems are coming at us at a faster rate each year. We desperately need competent professionals to expand efforts to solve these problems. Our instructional programs should, by all means, contain "awareness" components designed to increase the students' appreciation for the beauty and integrity of the environment, but our principal objective must be to provide our students with the insights, concepts, and skills necessary for effective environmental problem solving.

Content - What should the content of our environmental studies programs be?

- a. First and foremost, environmental studies programs should be interdisciplinary. Students must be exposed to as many perspectives as possible. Environmental problems are too complex to be solved or even understood from single-discipline perspectives. Incomplete perspective leads first to incomplete understanding of the problems and ultimately to incomplete solutions to these problems. As we have seen all too often, incomplete answers can be worse than no answers at all.
- b. The basic disciplinary threads of any environmental studies program should include the relevant facts and concepts about ecosystems; economic systems; political systems and environmental law; social and cultural systems; the production and consumption of energy and materials; pollution of land, air, and water; and, when possible, technological systems (engineering). More general topics should include concepts of time, information, entropy, general systems thinking, and a consideration of moral and ethical issues.
- c. Care must be taken to provide adequate integration of these disciplinary concepts. We must not be satisfied with providing our students with a myriad of facts and concepts. We must be willing and able to help them tear this information apart, sort it, and put it back together in new ways. It is through this process of analysis and integration that new ideas and approaches will emerge.
- d. One objective of the integration process should be the development and refinement of a theoretical and philosophical base for environmental studies. Such a base will facilitate our attempts to understand the very complex problems with which we grapple. Care must be taken, however, constantly to reassess our theoretical and philosophical ideas as new knowledge is generated.

e. Environmental studies should be primarily problem focused. The field of environmental studies was conceived in and has developed out of our recognition that we are faced with serious environmental problems. We must do everything possible to increase our understanding of these problems. We must also do everything possible to educate and train professional environmental problem solvers. "Environmental education" can afford the luxury of focusing on the long-term objectives of changing attitudes and life styles. We must look for solutions now.

f. Environmental studies programs should require students to become actively involved in the problem solving process. Coursework in environmental impact analysis should be a core requirement. Independent study, special problems courses, and internships are other vehicles for providing "hands-on" experience with environmental problems. Such experiences may be the most valuable of our students' college careers.

Do Undergraduate Majors Make Sense?

Environmental problems are too complex and difficult to be solved by individuals, whether they are specialists working from one disciplinary perspective or generalists working from an unspecialized, holistic perspective. Effective environmental problem solvers must have both types of expertise. In-depth training in a discipline provides students with a body of concepts and techniques that can be used to delve deeply into environmental problems from the perspective of that discipline. Interdisciplinary, problem-focused environmental studies provides students with the holistic overview necessary to see and approach environmental problems in their entirety. Undergraduate majors make sense only when both of these types of skills can be provided. This could be accomplished in two ways:

- 1) By an undergraduate major designed to provide both types of skills. In this approach, the depth component should be comparable in size and rigor to what would be required in a disciplinary major.
- 2) By an undergraduate major that is only taken as a "second" major. In this approach, the environmental studies major would provide the interdisciplinary breadth while the depth component would be provided in the student's primary major, which would be in a discipline.

What is the Most Effective Preparation for Graduate School?

The best preparation for graduate study in environmental studies will include three components. I list these in order of their importance.

- 1) Depth--a thorough grounding in the basics of at least one discipline. Students should have depth in some area of specialization. They should be biologists, chemists, economists, engineers, etc.
- 2) Experience--some indication that the student is serious about his/her involvement and is capable of producing results. This is the practical component. It gives the student the opportunity to show that s/he can step out of the ivory tower of academia and effectively apply knowledge, skills, and talents to solving real problems.
- 3) Breadth--a background in interdisciplinary environmental studies. Students should have an understanding of the breadth and complexity of environmental problems and of the differing disciplinary perspectives and approaches that may be brought to bear on these problems.

The priorities which I have assigned to these three components are based upon the following opinions and observations:

Disciplinary concepts are fundamental to the environmental problem-solving process. They are also basic to the whole process of interdisciplinary investigation. A firm disciplinary background serves as a "conceptual tree" upon

which new knowledge may be hung, a reference point to which concepts from other disciplines may be related, and a base from which more abstract, interdisciplinary ideas may be investigated. The development of this disciplinary depth is a vertical process requiring an extended period of time to complete. It cannot be developed in a graduate environmental studies program (nor should it be). It must be developed at the undergraduate level.

This is not true for the "experience" and "breadth" components. Both can be and are provided in graduate environmental studies programs. I place a greater value on the experience component than I do on the breadth component because experience at the undergraduate level is a good indicator of commitment to environmental problem solving and because students with such experience bring to a graduate program a broader perspective and a more mature sense of confidence than do students whose undergraduate backgrounds are purely academic.

Placement - What is the Outlook for Employment?

This is a very difficult problem. The jobs are there but they are difficult to find. Many employers such as governmental agencies, consulting firms, and private industry have positions on their staffs that should be filled by qualified environmental studies graduates. Unfortunately, most employers are unaware of the existence of this new pool of expertise. Our graduates who want employment in this field are able to find jobs, but they must take the initiative and get out and sell themselves to prospective employers. I believe that this is going to continue to be the pattern for some time to come. We must do all that we can to educate potential employers about the qualifications and abilities of our graduates. We have a selling job to do.

Summary

Environmental studies is an interdisciplinary, largely problem-focused approach to studying the nature and dynamics of our interactions with our natural/social environment. Emphasis here should be placed on the word "studying," for the pursuit of knowledge is the true raison de'etre for the field of environmental studies. Our instructional programs are outgrowths of the conceptual base developed through research and scholarly activity.

The goal of our instructional programs should be the production of effective environmental problem solvers. Content of these programs should include the following emphases:

- a) It should be interdisciplinary.
- b) It should include relevant material about ecosystems; social, political and cultural systems; energy, materials, and pollution; economic systems; and technological systems.
- c) Integration of concepts must be emphasized.
- d) A theoretical or philosophical base must be developed.
- e) It should have a problem focus.
- f) It should include opportunities for "hands-on" experience.

Undergraduate majors make sense most often as second majors. Our graduates must have disciplinary depth as well as interdisciplinary breadth. Undergraduate preparation for graduate work in environmental studies should emphasize in-depth disciplinary training, practical, hands-on experience, and interdisciplinary environmental studies in that order.

Employment opportunities are available but are usually difficult to find. A major effort is needed to inform potential employers about the qualifications and abilities of environmental studies graduates.

ARTICULATION BETWEEN UNDERGRADUATE AND GRADUATE PROGRAMS IN ENVIRONMENTAL STUDIES

Robert H. Frey¹

The basic thrust of this paper is oriented toward the articulation of undergraduate and graduate programs in environmental science. Although I will not spend considerable time on reviewing the usual definitions which delineate environmental science from environmental studies, it may be useful to at least establish a line of demarcation.

The prevalent argument suggests that environmental science is merely a subset of environmental studies. This premise is founded on the observation that "the problems environmental studies should ultimately address are those that involve human values, attitudes, and policy." The argument usually spins on to say that uncontrolled technology, which among other by-products creates environmental and health hazards, is not the problem *per se*, but rather is the symptom of man's perverted values. Some argue that environmental studies deal with these underlying values while environmental science treats only the symptoms of man's dysfunction with his physical environment. Conceptually, I agree with this position, but history documents the difficulty society has in changing its values, attitudes, and even its policies. In the meantime, air and water become even more deadly and the land is decimated by the multiple demands which are placed upon it by industry, recreation, residence and transportation.

I applaud and support the long-term objectives of environmental studies and, indeed, we have faculty, students, and research conducted on our campus which address these social issues. The fact remains that the immediate by-products of uncontrolled technology and the life styles of many Americans create problems such as water and air pollution, solid waste accumulation, wasted energy and multiple pressures on the land. These are precisely the kinds of problems which can best be solved through the application of the principles found in the biological, physical and engineering sciences; i.e., programs in environmental science.

Rather than to dwell on the differences between the concerns of environmental studies and environmental science, and perhaps unnecessarily develop internecine warfare, let me simply say we need both approaches. The campus I represent, the State University of New York College of Environmental Science and Forestry (ESF), emphasizes the use of applied and basic science to solve the problems of our physical environment. However, we also have a strong commitment to address, as well, the underlying social milieu.

It might be useful at this point for me to briefly describe the undergraduate and graduate programs at ESF to provide a basis from which later to make some generalized comments.

The College offers seven baccalaureate programs: resource management; environmental and forest biology; chemistry; landscape architecture; paper science and engineering; wood products engineering; and forest engineering.

At the graduate level, ESF offers the Master of Landscape Architecture and the master's and doctoral degrees in resource management and policy; silviculture and forest influences; environmental and forest biology; chemistry; environmental and resource engineering; and an interdisciplinary program in environmental science.

The articulation concerns at the College are directed both between lower-division and upper-division undergraduate study and between upper-division and graduate study. The College is moving towards an upper-division/graduate mode of operation.

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in which freshman and sophomore lower-division instruction in the basic sciences, humanities, and social and behavioral sciences will be taught at a two-year college, or a four-year college, and students will then transfer into ESF's specialized curriculum at the junior level.

At the graduate level, the College attracts students from a variety of undergraduate backgrounds, but still, the majority of graduate students have a firm foundation in the basic sciences. Relatively few, however, have an undergraduate major in areas precisely like our own undergraduate majors. In fact, fewer than ten percent of our total applicants for graduate study have an undergraduate degree from ESF. There is a somewhat greater variety of undergraduate backgrounds for those who apply to our graduate programs in landscape architecture and our program in environmental science which offers areas of study in water resources; environmental education/communication; environmental assessment and impact analysis; and environmental land use planning. We have rather few applicants with an environmental studies major as defined previously, and, on the whole, these applicants have not been very successful in gaining admission. Although the reasons vary for their lack of success, many of the environmental studies majors seemingly do not have a good grasp on why they wish to attend graduate school and normally do not have the requisite background for our programs.

The graduate programs at the College are tailored to meet the individual objectives and research interests of each student. As part of the degree requirements, each student must complete and successfully defend a thesis. The form of the thesis varies widely from the traditional bound volume reporting "bench" research to a local bestseller which describes the natural history of our county. Credit for the thesis varies, but it usually represents about 20 percent of the master's program and approximately 30-40 percent of the doctoral program.

The thread which connects the journey through lower-division, upper-division, and graduate study at ESF is the emphasis on the biological, physical and engineering sciences and their direct application to solving environmental problems. There are, however, considerable opportunities for students to broaden their program through courses offered by the College which integrate social and moral issues with the scientific ones. In addition, our students are able to take virtually any course offered by neighboring Syracuse University. This provides an incredibly wide opportunity for students to take courses from the fine arts, to public administration, to the social and behavioral sciences.

From the perspective of the programs I have just described for you, let me suggest several generalizations:

First, there must be a central theme for each student majoring in environmental studies. This "stake" in the ground may be either integrated within the program such as science is at ESF, or there may be another major taken along with environmental studies such as geography, political science, or English.

Second, there should continue to be a wide variety of approaches to environmental studies. There is no, and probably will never be, one best way to form a curriculum or define universal competencies for environmental studies programs. The issues involved are so broad as to defy packaging into any one program or approach.

Third, undergraduates in environmental studies programs who complete specialized programs, such as those at ESF, generally would do well to seek graduate programs which are somewhat broad. Conversely, students who complete broad undergraduate programs should seek more specialized graduate programs.

Fourth, environmental studies programs should be at the vanguard of American higher education in integrating instruction (including classroom, laboratory, field-work, and internship activities), research, and public service. I don't think there is any better reason for colleges and universities to assemble and energize their considerable resources than the environmental crisis, in its many physical and social faces, which now threatens our world.

THE UNDERGRADUATE ENVIRONMENTAL STUDIES CURRICULUM: DEVELOPMENTS WITHIN THE LIBERAL STUDIES TRADITION

Arthur B. Sacks¹

I. The Structure of Interdisciplinary Environmental Studies Programs

Like any other major at the undergraduate or graduate level, an interdisciplinary environmental studies curriculum is only as good as the faculty which directs it. At large traditional institutions of higher education, this often means that environmental studies programs offer the best the institution has to offer, mainly because the senior faculty of such programs tend to be the most productive, the most established, and the most powerful members of the campus community. The reason for this is clear: only the most secure faculty, those whose reputations are set, those who need not be overly concerned about tenure and merit increase decisions, can afford to articulate their independence and freedom from the constraints of traditional departmental structures. At traditional institutions, it is the powerful members of the faculty who can deal most effectively with the pressures placed upon them as individual faculty members and upon the interdisciplinary programs which they sponsor. This has always been true of interdisciplinary programs, regardless of their focus, because instructional and research dollars have traditionally been channeled through the disciplines. It has also been true that when the prime faculty movers who initiate interdisciplinary programs retire or die off, their programs have tended to atrophy and disappear.

Notwithstanding the quality of the faculty and their dedication to environmental studies instruction, research, and application to "real world" problemsolving, the concern expressed about interdisciplinary programs is not altogether unfounded. In times of budgetary retrenchment, close scrutiny of interdisciplinary programs is not only justified but mandatory. Those programs that cannot adequately explain their usefulness and their uniqueness probably deserve to be discontinued. Indeed, those interdisciplinary environmental studies programs that have floundered have done so because of an inability to define their missions clearly, and to differentiate themselves properly from traditional disciplines (e.g., botany, forestry, geology, soils, wildlife ecology, zoology). Such a lack of definition has resulted at times in an inability to create a reasonable curriculum which takes students down a clear path to a desired end.

This problem has been exacerbated by the complicated administrative structures and the difficulties of campus politics which seem to plague interdisciplinary programs. Often, for example, environmental studies programs do not possess a full complement of faculty necessary to maintain a well-rounded curriculum. If a majority of a given environmental studies faculty are political scientists, sociologists, and planners, in all likelihood and with all reasonableness, the curriculum will have a strong emphasis on policy and decisionmaking. Likewise, if a faculty is composed largely of engineers, chemists, and biological and computer scientists, it is to be expected that the curriculum will tend to concentrate on the technical and scientific aspects of environmental problems. It is of course a truism that any program takes the shape of its faculty, but is there an "ideal" structure for an environmental studies program? What should it teach students?

An ideal undergraduate environmental studies program would be comprised of a faculty from a diverse, balanced array of disciplinary and interdisciplinary backgrounds whose allegiance is to the Program, and whose tenure and merit status are tied directly to their participation in environmental studies instruction and research. Because environmental studies is by definition interdisciplinary, and because it is founded on the principle that in order to understand environmental questions and find solutions to environmental problems it is necessary to grasp

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the complexities and interrelationships of biological and physical phenomena and the impact of human actions and institutions on ecosystems, environmental studies programs should employ institutional and policy experts, humanists, social scientists and human behaviorists, as well as biological, physical, and systems scientists.

Environmental studies should be considered a development upon the liberal studies tradition which emphasizes both broad background and depth within a defined concentration. Although there is a need for environmental technicians, pollution controllers and the like, an ideal undergraduate studies program, as defined here, would not be a professional program in the way Nursing and Engineering are. Instead, environmental studies should seek to present and integrate a wide variety of perspectives such that students so instructed will have the tools, the awareness, and the sensitivity to comprehend the complexity of environmental questions and problems. But how should a curriculum be organized, and what should students be expected to know?

II. Curricular Nitty Gritty

Like most other liberal studies curricula, an environmental studies program should be predicated on the necessity for students to acquire both breadth and depth. However, instead of requiring students to obtain exposure to a broad, almost random smattering within the basic fields of knowledge, breadth requirements should be organized around environmental issues. The depth requirement, on the other hand, should allow for students to elect either a specific problem (e.g., energy; world food) or a bundle of issues under defined categories (e.g., environmental policy; renewable and nonrenewable resources) upon which to concentrate.

A. Breadth

Ideally, all environmental studies students should have a strong grounding in the basic sciences and in the tools used to organize and quantify data.

Specifically, a year each of biology, chemistry, physics, earth sciences, and mathematics (calculus level), as well as at least one semester each of statistics and computer science, should be present in the curriculum. These courses are necessary to provide the basic framework for understanding the scientific issues and principles governing environmental questions.

All students within the program should also be required to complete a series of courses which focus on specific aspects of ecosystems and how they affect the total system. The goal of these should be to provide students with certain minimal competencies and establish familiarity with the "languages" of differing disciplinary perspectives. Thus, students should be made aware of fundamental ecological principles affecting plant and animal communities, and they should be able to see the interrelationship of evolution, genetics, and population dynamics. Each student should be expected to have some understanding of the economics and politics of environmental issues. They should have exposure to the ethical and legal considerations which are or which ought to be a part of environmental policy formulation and decisionmaking. In addition, students should be required to take work which would familiarize them with the issues surrounding the origin, use, allocation, and preservation of renewable and non-renewable resources. Every student should have at least one course which tackles a broad range of current environmental problems (e.g., world hunger, energy, biological degradation, and pollution), so that they will have concrete information about these problems and be aware of their scope and complexity. Finally, as a last step in the breadth sequence, every student should be required to take at least one course in environmental systems thinking and systems analysis methodology.

As part of an ideal breadth requirement, environmental studies students should also be required to take two other courses in order to acquire necessary skills:

1. a course which instructs them in the techniques of environmental impact analysis and assessment; and
2. a course which introduces students to a variety of environmental communications, specifically, technical writing, environmental impact statement writing, environmental journalism, and grant proposal writing.

B. Depth

The depth requirement should allow a student to develop a concentration within his/her primary interest area. The student should be allowed to focus upon either an environmental problem such as the energy crisis or world hunger, or upon a more general area such as environmental policy studies or resource use. Again, the basic technique should be interdisciplinary, although a student should be permitted to elect several courses in a single discipline if deemed appropriate by the student and a faculty advisor assigned to assist the student in course selection. Minimally, fifteen credits of actual courses are necessary to develop a focus if it to be of significant value.

Students should be encouraged to do independent study as part of the fifteen credit depth requirement, and, ideally, students would be required to have some kind of significant "hands-on" experiential learning component as well. A faculty-coordinated internship with a local, state, regional, or federal agency, or with industry or an environmental consulting firm, would be the best capstone to the entire program. Internships would require a contracted goal and a finished report. However, because of the administrative difficulties involved with internship programs, an extended field research experience, or a senior thesis based upon independent research involving lab work and/or field data collection could serve in lieu of the internship.

By combining both the breadth and depth requirements, the environmental studies major would move towards eliminating the concern often voiced about interdisciplinary programs that they tend to be far too broad, producing students who simply do not know enough. Clearly, the program outlined here goes far beyond the traditional 30-60 credits for a major. It possesses an intensity and a rigor such that only committed students would elect it, and only very good ones would complete it. Nevertheless, there is legitimate reason to suggest that students so prepared would meet with difficulty in specific graduate programs. This is certainly true with disciplinary graduate programs which some students might want to pursue, but it is also true for much interdisciplinary graduate instruction. It can be reasonably argued that somewhere in a student's education, he/she should acquire the depth and maturity that only extensive study within a single discipline can bring. The claim is that, if nothing else, a traditional disciplinary major enables a student going on to an interdisciplinary graduate program to appreciate the narrowness that even the best disciplinary training can produce. More practically, many graduate programs, disciplinary as well as interdisciplinary ones, require students to have a disciplinary undergraduate major in order to be considered for admission. Therefore, undergraduates enrolled in the type of environmental studies program described here would be best advised to take a traditional disciplinary major as well if they wish to pursue graduate studies.

III. A Brief Apology.

If the concern that students going on to graduate school should have a disciplinary background is legitimate, why then should we have undergraduate majors in environmental studies in the first place? The answer is evident: not everyone goes on to graduate school, and there are tasks for those who do not. Although it is true that environmentally-related jobs often tend to be "high-powered" ones requiring expertise which necessitates graduate training, those who have been involved with the placement of students are aware that environmental studies graduates have been and continue to be placed with state departments of natural resources, public service commissions, energy and environmental quality offices, city and county offices and agencies, federal agencies (e.g., EPA, BLM, OEE), environmental communications operations, consulting firms and industry.

More importantly, as an undergraduate education becomes available to more and more people, as a demand for information about the way environmental systems operate becomes more pressing, and as the need for an educated populace aware of environmental problems and capable of making reasonable decisions increases, institutions of higher learning are increasingly obliged to organize instructional efforts which are responsive to these needs and to the harsh environmental realities which loom larger every day. The great universities of this nation as well as our smaller colleges must resist the temptation, disguised as a justified need, to cut back on interdisciplinary environmental studies program in favor of traditional ones. Simply put, we are staring at the world's future and it does not look good. We cannot afford to set environmental studies aside until a more economically secure age for higher education appears as a deus ex machina to resolve the current financial pressures facing our institutions. As responsible educators and intellectuals, we must make the best use of available resources and continue to nurture programs which have the potential of producing cadres of men and women capable of countering the ignorance, greed and carelessness which daily inch us forward toward environmental disaster.

GOALS, CLASSIFICATION, AND EVALUATION OF ENVIRONMENTAL STUDIES PROGRAMS

Judith M. Schultz¹

It is less than a decade since the initiation of the majority of environmental studies programs in institutions of higher learning in the United States. Yet, administrative discourse, exchange of ideas, and interest in evaluation of such programs and their graduates have evolved in this short period of time. While there need not be "an agreed-upon" curriculum for such programs, there appears to be an emerging consensus upon some common components and directions of such programs. Such indicators demonstrate the emerging institutionalization of environmental studies programs.

The Program content of environmental studies programs and the evaluation thereof must be determined by the goals and objectives of the Program. Some common aspects of Program content and characteristics of current graduates as appear to be emerging from existing undergraduate environmental studies programs include:

1. Employable skills, or basis for entering a graduate or professional school. Such examples are:
 - a. Technical (analytical) training
 - b. Impact statement writing
 - c. Problem-solving training and ability
 - d. Holistic (systems approach), interdisciplinary, critical, and long-range thinking, utilizing training in the disciplines (of biology, economics, political science, history, sociology, etc.) as a basis for inquiry
 - e. Dual major
 - f. Basic disciplinary courses in multi-disciplinary majors followed by interdisciplinary courses.
2. Ethics and values clarification
3. Internship (quarter, semester, year) and exposure to political processes and real-world problem-solving.
4. Classical environmental case studies

Further, graduates of undergraduate programs should have a firm foundation in basic ecological concepts, a sense of aesthetics, an understanding of bureaucracies and the free enterprise system (as well as other economic systems.) A firm foundation in the basic concepts and philosophies, and the central dogmas of disciplines already mentioned is a prerequisite.

It is important to recognize the societal need for both two-year "degree" environmental para-professionals and graduate "degree" environmental professionals. In addition, for some students, the four-year environmental program may serve as part of a dual major to enrich their lives as citizens, and may not be followed by a graduate degree. Thus, undergraduate majors in environmental studies may be fulfilling three important societal needs if well designed.

The most effective four-year undergraduate preparation for an environmental emphasis is a ~~thin~~ broad foundation for the specialization which must later follow in graduate school. The two-year undergraduate environmental degree program is a mini-version of this scheme, in that basic concepts and breadth are usually emphasized in the first year, while specialization for marketable career skills are taught in the second year. Such a combination allows the student to be readily employable in just two years. While nearly all two-year environmental programs are described as "technical programs," it is vital that they also combine

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technical training skills with disciplinary and ecological conceptual basics, environmental ethics and aesthetics, holistic thinking, and problem-solving techniques. It is insufficient to produce mere technicians. The environmental technician must also be a thinking technician.

At present, employment opportunities for two-year environmental technical graduates far exceeds the number of graduates available. As a result, many four-year graduates of traditional disciplinary undergraduate majors are returning to two-year programs to obtain employable skills. This phenomenon is undoubtedly occurring as a result of many students entering baccalaureate programs not realizing that their degree program has been designed as a stepping stone to the specialization of graduate school. Often, their grades are not sufficiently high enough to enter graduate school. The specialization of the second year of the two-year technical program is thus sought to substitute for the specialization of graduate school.

Nearly thirty percent of students entering two-year programs have the capability for continuing through a four-year degree program. The usual major selected is among the choices of disciplines such as biology, chemistry, or engineering if a four-year environmental studies program is unavailable. The student should be assisted in setting goals for an environmental emphasis in graduate school. Environmental engineering, ecology, or industrial hygiene are among the most common choices. Because of the specialization received in the second college year, the two-year graduate capable of continuing his/her education may be better equipped for the specialization of the graduate school than the disciplinary-based four-year graduate.

Transferability of credit from two-year to four-year programs may be a problem only insofar as some of the highly specialized skills courses designed for employability are not duplicated in the four-year curriculum. They can, however, be substituted for electives.

Evaluations of environmental studies programs can be a positive, constructive process if approached in the appropriate manner. Evaluation is essentially an information-gathering process. It can only occur if goals and objectives are already in existence and measurement and decisions (via information-gathering) can be made as to the degree in which goals and objectives have been met, or whether they are in fact realistic. Quantitative evaluation criteria include such components as enrollment trends, and most importantly, factors affecting such trends, and cost/benefit analysis of program. (NOTE: Cost factors are often analyzed without simultaneous comparison of benefit). Below are listed suggestions for qualitative criteria for program evaluation. Such criteria may also simultaneously suggest program objectives and goals.

Qualitative Criteria for Program Evaluation

I. Quality of Instruction

1. Assessment by students
2. Assessment by faculty
3. Assessment by graduates
4. Quality of students attracted and retained (including transfers)
5. Quality of faculty attracted and retained
6. Effectiveness of student advising
7. Distribution of instructional load by faculty rank
8. Responsiveness to changing needs; innovation
9. Faculty reward system
10. Responsiveness to student needs
11. Breeds new ideas
12. Stimulates thinking
13. Not largely duplicated by other programs
14. Mastery of present knowledge
15. Prepares for continued pursuit of knowledge
16. Good use of facilities
17. Prepares student for occupation in chosen discipline

18. Induces constructive skepticism (openmindedness)
19. Prepares for alternative futures
20. Peer, student, self-evaluation in terms of using University-wide criteria which also allow for individualistic considerations as related to goals of the Program and the environment in which the course or program is offered
21. Instructional load of members of Program
22. Responsiveness to changing needs, flexibility, innovations
23. Generation of new ideas, originality of approaches, sharing of ideas, experimentation, outreach
24. Mastery of knowledge and practical applications
25. Challenges, motivation, and inspiration of students and institution
26. Clear interpretation of ideas and theories
27. Promotion of philosophy of discipline as well as interdisciplinary approaches
28. Provision for views and information beyond the current level taught
29. Availability to help students (advising, office hours, review sessions)
30. Good organization

II. Quality of Research, Service, Professional Performance

1. Accreditation rating, etc.
2. Other ratings by professional societies
3. Outside support, financial and otherwise
4. External recognition of staff: who's who, commissions, awards, offices held, etc.
5. Continued acquisition of new knowledge
6. Continued reinterpretation of present knowledge
7. Publications and other creative works
8. Recognition and productivity of graduates
9. Good use of facilities
10. Prepares graduate for worthwhile work in chosen discipline
11. Achievement measurable
12. Support, internal and external
13. Publications
14. Application of research to teaching (undergrad., grad.) institution, community

III. Contribution to Institution as a Whole (Centrality) and Community

1. Relation of program to University missions
2. Contribution to other programs
3. Avoidance of unnecessary overlap
4. Creates loyal and interested alumni
5. Stimulates university/college growth (not limited to numbers)
6. Develops "school spirit"
7. Enhances the quality of university life: intellectually, physically, emotionally, culturally
8. Contributes to the university/college community relationship
9. Contributes to a community of cohesiveness in the university/college
10. Generates enthusiasm and excitement
11. Memberships, elected offices, appointments to national or locally recognized professional organizations
12. Consulting to community, industry, government
13. Publications (journals, books, other creative works)
14. Educational assistance and outreach to varied groups (on individual basis, organizing workshops, conferences, etc.)
15. External recognition (awards, commissions, who's who)
16. Institutional committees, task forces, etc.

IV. Value of Program to Society; Uniqueness

1. Response to societal needs
2. Enhances societal values
3. Solution of societal problems
4. Value of graduates to society
5. A worthwhile "unique" program (with limited resources it cannot be great on all fronts; have we selected soundly what we emphasize?)
6. Serves as a model for adoption by others

V. Professional Growth

1. For students (provided for) increases their opportunities for responsibility and enhancement of intellectual, cultural, physical, emotional growth.
2. Faculty
 - a. Attendance and/or participation in conferences
 - b. Pursuit of advanced degrees
 - c. Research
 - d. Publications
 - e. Participation in organizations, internally and externally
3. Staff
4. Institutional
 - a. Avoidance of overlap
 - b. Contribution to other programs
 - c. Development of cohesive spirit at institution

VI. Potential

1. Program concentrates more on future than present need
2. Program fits long-range planning and missions
3. Attracts leadership personnel
4. Future response and support from citizens and government
5. May develop good models
6. Long-range improvement in university/college community relationship

ENVIRONMENTAL STUDIES PROGRAMS IN COLLEGES AND UNIVERSITIES TODAY

Clay Schoenfeld and John Disinger¹

This report documents the impact of environmental concerns on higher education in recent years as expressed in university courses, curricula, programs, and centers that have modified conventional disciplines or led to new multidisciplinary arrangements, schools, and colleges. Barring English composition and math, few university subjects are being offered today in so many diverse ways and places, by such a mixture of schools, departments, and professors, as that complex of cognitive content and affective process known, precisely or not, as environmental studies. Today no self-respecting campus is without some gesture toward environmentalism, and the more substantial enterprises represent a major departure in university focus and format toward interdisciplinary, multi-function, problem-oriented teaching, research, and outreach. The history of higher education offers few such examples of so wide-spread, rapid, and deep a response to changing public needs and pressures, within an overall framework of responsibility for academic standards, as that chronicled in this report.

Ten years ago (Summer 1968) Educational Record carried an article called "Environmental Education and the University." According to the computers that keep track of such things, it was the first time the terms "environmental" and "education" had been linked in the title of a paper in a scholarly journal. (But since one author of this article was the author of that one, he knows he did not invent the alliance.)

The 1968 paper was essentially a call to arms: "The energies of the campus must be so redirected that those involved in environmental management can share in skills and resources the university can contribute to the solution of public problems through teaching, research, and extension."

What has happened in the decade hence? How have America's colleges and universities responded to the environmental era? Are their responses fads or fixtures?

The authors have recently completed a continent-wide reconnaissance of representative environmental studies programs in place in four-year and post-graduate institutions, public and private, large and small. The compendium of detailed case studies assembled has been published by the Educational Resources Information Center of the National Institute of Education at The Ohio State University. This paper is a review of their analysis of the state of the art in environmental education on the campus today.

This is not a quantitative survey of environmental departures in university enterprise; our case studies were not selected at random. But neither were they deliberately chosen to give the reconnaissance a particular slant. We used as our initial point of entry to universities the summer session deans holding membership in the Association of University Summer Sessions--50 major institutions of varying size, location, structure, and mission. (Summer deans tend to be knowledgeable about broad developments on their campuses.) We asked each dean to "nominate those environmental programs or activities that you believe to be somewhat special at your institution or unusually effective." We also asked ERIC computers, staff, and consultants to identify varied environmental studies-type programs of recognized substance. After eliminating duplications

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among types of programs and institutions, we invited some 60 selected deans, directors, or chairmen to summarize "what your program is, what it does, for whom, why, how, where it came from, where it's going, in what ways it is representative of developments in your field across the country, and in what ways it is unique, sources of funding, measures of performance, and so on." Some programs responded; some did not. The net results of our reconnaissance are 45 case studies, reasonably representative of types of university adaptations to the upsurge in environmental interest: 1968-1978. We have given the broadest possible scope to environmental education, permitting it to encompass undergraduate general studies, varied graduate and professional programs, basic and applied research, and extension and continuing education. We did, however, limit our view to four-year-or-more institutions, two-year colleges having been represented in our earlier Environmental Education in Action--I (ERIC-SMEAC 1977).

The Environment of Change

As custodians of our culture, universities understandably are loath to change their configurations with any dispatch. There is still to be found on any campus, alive and well, the vestiges at least of the trivium and quadrivium that were, all there was when the higher learning came to the New World. But universities can and do change. As society's font of new knowledge and new knowledge-seekers, they must. We see in environmental studies one of the most recent manifestations of the dynamic nature of the university. Perceiving new, or at least renewed, environmental problems not wholly amenable to attack by existing configurations and curricula, the university has fabricated new, or at least remodeled, approaches and instrumentalities, yet without dismantling its basic order. In turn, changing university enterprise has stimulated political if not social change in the patron community. It is this vital entente between public university and university publics that is the very essence of the higher education today.

In the late 1940's three prescient books appeared--and then disappeared with what seemed at the time no trace of impact: Fairfield Osborne's Our Plundered Planet, William Voigt's Road to Survival, and Aldo Leopold's Sand County Almanac. Collectively the authors viewed with alarm a rampant growth of heedless technology, and called for a new "ecological conscience" if the world were to be saved for human grandchildren and "goose music." If anybody listened, the campuses officially did not. At the time they themselves were apostles and examples of growth and development. Besides, wouldn't Resources for the Future, Inc., soon announce that the only thing we had to fear was fear itself?

Yet, just below the surface of ebullient university affairs there were emerging individual faculty and students with a growing concern for a collapse of environmental quality and resource quantity they thought they could project. Depending on their disciplines, their points of departure were invariably the threats posed by what would come to be called the four P's: population, pollution, pesticides, and people. By the late 1950's and early 1960's, prototype environmental studies professors and their acolytes were beginning to identify themselves in publications, public hearings, and informal seminars.

Distinctions from Environmental Sciences

Environmental studies can encompass, but are not synonymous with, the environmental sciences. The latter are the biophysical "hardware," so to speak, of environmental studies, in contradistinction to the social science and humanities "software." More explicitly, the environmental sciences include such diverse fields as "meteorology, climatology, plant and animal ecology, oceanography,² agriculture, geochemistry, soil engineering, civil engineering, and many more".

The environmental sciences, of course, play a major role in any environmental

²Lapedes, Daniel N. 1974. Encyclopedia of Environmental Science, Ed. New York: McGraw-Hill.

studies program, but only one role. To address any environmental problem at its root is to deal with the fundamental cause--man and his ideas. Indeed, "the conclusion cannot be avoided: science, undiluted with ethical and humanitarian influences can be humankind's greatest problem rather than its greatest blessing."³ Environmental studies seek to bring perspective to both the sciences and the arts.

Relationships with Ecology

If only because "eco" is a handy tool for newspaper headline writers, the term "ecology" has often been bastardized into a synonym for environmental studies and even for the whole of the environment. But ecology was not born on E-Day, 1970; its history is long. The term itself was coined by a noted German biologist, Ernest Haeckel, in 1866 as a label for "the whole science of the relations of the organism to the environment, including, in the broad sense, all the 'conditions of existence.'" If textbooks are any evidence, by the 1920's four distinct ecological sciences had emerged in the United States: oceanography, limnology, plant ecology, and animal ecology. Social ecology was not to be recognized in any formal sense until the 1960's.

Two near-revolutions overtook the ecological sciences in the 1960's. Big money and big computers brought a switch at least in part from what has been called qualitative "car-window" research to quantitative mathematical ecosystem modeling. And the rise of the environmental movement projected ecologists into the public arena, or perhaps it was vice versa. Today, while all sciences contribute to the factual describing of the universe in which man functions, it is interdisciplinary ecology that integrates the information available into an understanding of the ecosystems of which man is a part, which he in part creates, which he can readily destroy, and the rules of which he must live by however he manipulates them.⁴ Aldo Leopold⁵ expressed all this eloquently in his "land ethic," and there have followed ecological spinoffs into philosophy, public health, history, art, literature, psychology, sociology, and other disciplines--the array of environmental studies.

Links with Environmental Education

Some persons consider the terms "environmental studies" and "environmental education" interchangeable. Others might say environmental education is the process of acquiring, and applying, the content of environmental studies. While there is by no means a consensus on a working definition of "environmental education," the one that would probably get as many votes as any among professional environmental educators might be that evolved from a recent Belgrade conference under UNESCO auspices:

Environmental education is a life-long, multidisciplinary approach to teaching, mass communication, community participation, or some other strategy or combination of strategies aimed at the development of a world population that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations, and commitment to work individually and collectively toward solutions of current problems and the prevention of new ones.⁶

At many universities, environmental education is the province of the school or department of education, while environmental studies "belong" to all the other schools or colleges. The distinction may be handy, but it may be unfortunate, too.

³ Nash, Roderick. 1976. "Logs, Universities, and the Environmental Education Compromise." The Journal of Environmental Education, 4(3): 39-41.

⁴ McIntosh, Robert P. 1976. "Ecology Since 1900." In Issues and Ideas in America, Taylor and White, eds., Norman, Oklahoma, University of Oklahoma Press.

⁵ Leopold, Aldo. 1949. Sand County Almanac. New York: Oxford.

⁶ UNESCO-UNEP. 1976. "The Belgrade Conference." Connect 1 (1): 1-4.

The Emergence of the Environmental Approach

It is difficult to say exactly when the word "environmental" became associated with the words "studies" or "education." The "environmental sciences" had been around for some time in the 1950's, but the connotation was always of the bio-physical sciences exclusively. "Conservation" was the original accepted term for general university studies in resource management.

The specific term "environmental education" was probably first introduced by Mathew J. Brennan, Director of the Pinchot Institute for Conservation Studies, speaking to the American Nature Study Association in 1964. By May, 1968, a National Conference on Environmental Education had been held in New Jersey. By the fall of 1969 there had appeared the first issue of The Journal of Environmental Education. The federal Environmental Education Act shortly followed.

In general, it was elementary and secondary school people and resource agencies that adopted the term "environmental education," usually as a substitute for "conservation education" (although in 1968 the national Conservation Education Association refused to switch, leading to the birth of the National Environmental Education Association). While schools and colleges of education developed courses in environmental education pedagogy and research, universities themselves tended to adopt as their umbrella term the rubric "environmental studies." By 1966, environmental studies had the first of what was to become a flood of textbooks--Future Environments of North America, by Frazier Darling and John Milton, growing out of a 1965 national conference on "harmonizing the works of nature and man."

While some may see a persistent logomachy between "studies" and "education", the distinctions would appear more apparent than real.

Attributes of Environmentalism

It is probably worth emphasizing here, however, that there are important distinctions between the "old conservation" and the "new environmentalism." In terms of its scope, environmentalism attempts to be multi-faceted. Whereas yesterday we tended to treat soil conservation, water conservation, wildlife conservation, urban engineering, and so on, as separate pursuits, today we try to understand, relate to, and adapt to the ecosystem unity of all humankind-environment relationships. In terms of its focus, then, while environmentalism is humanity-centered, while our primary concern has shifted from the survival of remnant redwoods and raptors to the survival of the human species itself, the shift has been accompanied by a new-found recognition that any concern for human welfare must encompass a concern for the total environment of which humankind is a part, not apart. In terms of its locus, while the old conservation conjured up images of open country, environmentalism incorporates the pressing problems of the city. In terms of its political alliances, conservation was linked to such orthodox causes as depression pump-priming, national defense, and outdoor recreation; the new environmentalism, on the other hand, owes allegiance to neo-Malthusian population control. It is in its basic cultural orientation, however, that the new environmentalism differs most strikingly from its antecedent, conservation. The latter stood clearly for economic development, for the infinite goodness of "progress." Pinchot himself said so.⁷ Environmentalism, on the other hand, reflects a growing suspicion that bigness is not necessarily better, slower may be faster, and less can be more. While we are concerned about quantities of natural resources, we are also concerned about the quality of the human experience.

All these attributes of environmentalism are reflected in environmental education or environmental studies, however defined. The two share certain common denominators. First, there is a hard core of ecological content. Second, a recognition of worldwide problems of crisis proportions. Third, a component of conscience, of a value system. And fourth, a commitment to private and public action. The

⁷ Pinchot, Gifford. 1947. Breiking New Ground. New York: Harcourt, Brace, and World.

whole is focused on a comprehensive rather than a compartmentalized approach to change in people-land relations, be they open-country or urban. Frequently, there is added an element of career education.

A basic message of environmental education or environmental studies is interdependence-- that everything is connected to everything else. That is "the principal intuition of the 20th century."⁸ The practical problem lies in how to recognize and effect sound, fair trade-offs among energy, economy, and environment.

The outlines of a constructive "North American environmental ethic" were postulated at a recent prestigious national environmental education seminar. In sum, the seminar participants agreed "we must redefine the pursuit of happiness" but not abandon the pursuit.⁹

The Environment of Environmental Studies

It is unsophisticated, of course, to think that environmentalism "burst upon the scene," so to speak, in the 1960's. The antecedents of environmentalism as a concept were many, going back at least to George Perkins Marsh's Man and Nature in 1864; as a political force, environmentalism inherited the infrastructure of a number of strong conservation organizations, some of which had been operative since the early 1900's. Yet, just as there were qualitative differences between the old conservation and the new environmentalism, so did public awareness, interest, and even support take a quantum leap at the turn of the decade, foreshadowed by the passage of the National Environmental Policy Act in 1969.

What triggered the mass irruption of environmental studies on college campuses across the country? Even from the perspective of history we are still not sure what inspired the rise of the earlier conservation movement at the turn of the century. Did it take its impulse largely from a technocratic gospel of efficiency, or from a populist revolt against wasteful monopolies, or from an evangelical concern for Nature's vast, pulsing harmony? Probably from all three. John Gaus has identified the critical elements in the "ecology" of any institution or movement as "people, place, physical technology, social technology, wishes and ideas, catastrophe, and personality."¹⁰ A brief examination of these factors at work in and on the campus in and around 1970 may help explain the emergence of environmental studies.

American people--students and professors alike--had been on a decade-long emotional trip that had left them both frustrated and pent up: multiple assassinations, civil rights confrontations, Vietnam, cost of living, crime in the streets, campus sit-ins. F. Scott Fitzgerald once described a somewhat similar era: "all gods were dead, all wars fought, all faiths in man shaken." We were ready for a cause we could believe in. It was natural that the new conservation would supply it. Ever since we first dropped anchor off Plymouth Rock, Americans have turned periodically to Nature for inspiration and challenge.

Yesterday's environmental degradation was usually over the hill and far away--in somebody else's dust bowl, somebody else's canyon, somebody else's boundary water canoe area, somebody else's forest. But the place of environmental degradation in the 1960's was where most people live--in the foul air, fetid water, and clogged arteries of the city. Millions could smell, taste, hear, and see the problem now, often in college halls themselves.

⁸Perlinski, Jerome. 1975. "Positives and Negatives," in Schafer and Disinger, Eds., Environmental Education Perspectives and Prospectives, 10-13. Columbus, Ohio: ERIC/SMEAC.

⁹Aldrich, James L., Anne M. Blackburn, and George A. Abel. 1977. A Report on The North American Regional Seminar on Environmental Education. Columbus, Ohio: ERIC/SMEAC.

¹⁰Gaus, John, 1947. Reflections on Public Administration. University, Ala.: University of Alabama Press, 6.

The physical technology of the 60's had vaulted us to the moon, and thus had given us renewed confidence in our capacities, but from our new vantage point in the cosmos we looked back and were struck as never before by the fragile, finite character of Spaceship Earth. By invading one new frontier we rediscovered another, a state of harmony between humankind and Nature.

Continuing along the Gaus outline, developments in the social technology of the 60's played a signal role in the rise of environmentalism. The voice of the mass media had become increasingly dominated by a relatively small coterie of paperback publishers, magazine editors, and TV commentators. When these communication gatekeepers almost simultaneously seized on the pesticide-population-pollution syndrome as the big story, the message was inescapable. Beginning with Rachel Carson's Silent Spring in 1962, on down through Arthur Godfrey's "Portable Electric Medicine Show" in 1972, the mass media brought ecological awareness into America's living rooms and classrooms. The 1969 National Environmental Policy Act tended to increase press coverage of environmental impacts by "officializing" environmental issues.

In their wishes and ideas, all the great ecological philosophers had always said that true conservation would require a profound change in American values. Few people listened. But in the 60's the youth of the country began to understand, if only because it matched a wave of anti-materialism sweeping their ranks. Perhaps nothing so accounts for the current popularity of environmental studies as this marriage of orthodox ecological ethics and the innate iconoclasm of the young, coupled with their commitment to the tactics of confrontation.

There was no single, Pearl Harbor-type catastrophe responsible for the rise of environmentalism, but there were multiple mini-catastrophes: death-dealing smog in the east, oil spills in the west, water pollution in the north, fish kills in the south--there was no place to hide any more. Once bucolic retreats, the campuses themselves had become cement monotypes.

No single national personality--no Dewey, Jordan, Butler, Eliot, or Harper--spearheaded the move to environmental studies; just as the environmental movement itself had no single leader in the Teddy Roosevelt mold. On many a campus, however, a local leader or cadre of leaders came to the fore. What was striking was the diversity of their backgrounds. There was scarcely a discipline that did not produce on some campus a chairman of an environmental studies committee. Such diversity has lent a unique "personality" to the environmental studies "ecosystem," and speaks well for its stability and longevity.

Out of the changing people, places, technology, aspirations, fears, and personages of America and its universities at the turn of the decade came a new spirit and new curricula. The spirit was an embryo ecological conscience. The curricula were an attempt to give that conscience substance and application.

The Scope of Change

It is striking the way in which the environmental studies programs we examined have sprung from such a wide range of disciplines and professional schools, as attested by the academic backgrounds of the leaders. Represented are one or more ag extension educators, architects, artists, biologists, chemists, civil engineers, ecologists, economists, elementary teacher educators, entomologists, environmental educators, foresters, geographers, geologists, historians, home economists, journalists, landscape architects, lawyers, limnologists, meteorologists, music educators, outdoor educators, philosophers, physicists, poets, political scientists, public administrators, sanitary engineers, science educators, social studies educators, sociologists, soils scientists, statisticians, systems engineers, zoologists. No doubt, if the leaders of all environmental studies programs could be identified, scarcely no discipline or school would be unrepresented. Perhaps under no other rubric does a specialist in general pedagogy from Murray State's modest environmental education program in Kentucky commune with a research ecologist from the University of California-Berkeley's sprawling School of Natural Resources or with an organizational theorist at SUNY-College of Environmental Science and Forestry at Syracuse.

It is likewise striking the depth to which environmental studies concepts have penetrated the academic structure--wholly new instructional curricula and organizational arrangements at the undergraduate level, wholly new master's degree programs, wholly new cross-discipline Ph.D. research arrangements, wholly new extension configurations. While in some cases the changes may prove to be more cosmetic than surgical, there is no doubt the impact of environmental studies will long be in evidence on the broad physiognomy of the campus. In our case studies alone we found programs based in the disciplines of the arts, botany, chemistry, ecology, economics, geography, geology, history, limnology, meteorology, philosophy, physics, political science, sociology, and zoology; in professional schools of agriculture, architecture, education, engineering, forestry, home economics, journalism, law, public administration, urban planning, wildlife management; and in custom-built specialized centers, liberal arts faculties, multidisciplinary institutes, and outreach instrumentalities.

Environmental studies know no geographic barriers. From Florida State's unique work with community leaders, and the Cook College-Rutgers novel program in international environmental studies, through the great heartland Schools of Natural Resources at Ohio State and Nebraska, to the specialized ECO-Education program at San Francisco State, environmental studies have made their imprint on colleges and universities everywhere, public and private, large and small.

The Nature of Change

In keeping with the significant diversity among institutions of higher education, the programs or instrumentalities of environmental studies that have emerged at universities in the past 10 years are not carbon copies of each other. Each tends to be indigenous to the traditions, missions, and ethos of a particular campus. Withal, our case studies have revealed certain what might almost be termed remarkable similarities among types of environmental studies enterprise continent-wide.

Etiology

Except where a few environmental studies programs sprang overnight to full flower in new universities, environmental studies have had strikingly familiar upbringings.

On a typical campus there emerged, as we have said, a cadre of professors with shared environmental concerns. Invariably they were relatively senior staff with impeccable reputations in their respective disciplines, secure in the power structure and free to pioneer. They organized as an ad hoc committee to propose university departures. In due course they were institutionalized as a center, group, program, or some other such rubric in, but not of, the existing hierarchy of departments, schools, and colleges. The funding was tenuous, the in-house reward system non-existent. Young assistant professors joining the configuration lived hazardously in terms of merit raises and promotions. Gradually, the university formally recognized the instrumentality in one way or another, although the adaptation may have been accompanied by some blood on the floor.

Taxonomy

The resulting genus environmental studies has three principal species. On the one hand there is the program with an emphasis on undergraduate teaching. A sub-species in turn presents environmental studies as the new core of a broad liberal arts-and-sciences education for responsible citizenship, typified by the University of California-Santa Barbara's "generalist" curriculum, which took shape in the shadow of the infamous 1969 oil spill. A second sub-species offers environmental studies as a technical preparation for certain careers in environmental control, as at Kentucky's Moorehead State University; in environmental interpretation, as at San Francisco State; or in environmental teaching, as at The Ohio State University-Newark. The two sub-species may inter-breed, as in

Stanford's Environmental Earth Sciences Program, whose graduates head for advanced work in planning, engineering, geology, and law.

A second principal species of environmental studies focuses on multidisciplinary master's work in conventional or exotic fields associated with varied aspects of environmental management. A sub-species tends to give products of the environmental sciences a social viewpoint, as in the Environmental Health program at the University of Kansas, enrolling science majors and engineers. Another sub-species exposes students of the social studies to technical subject-matter, as in the University of Georgia's work with majors in social studies education. These sub-species also inter-breed, as in the University of California-Berkeley's Energy and Resource Group, the environmental communications programs at The University of Wisconsin-Madison, and the University of Pennsylvania's National Center for Energy Management and Power.

The third species of environmental studies takes its impetus from interdisciplinary research applied to societal needs, and develops custom Ph.D. programs to hand-tool the new breeds of scientists called upon to investigate new approaches to new knowledge. Some such programs are rooted in the biological and physical sciences, as in the University of Virginia's Department of Environmental Sciences; others in the social sciences, as in Indiana's distinguished School of Public and Environmental Affairs; others in the professions, as in Missouri's School of Home Economics.

Virtually all elements of the genus environmental studies are characterized by a concern for the affective or value dimensions of the field beyond its cognitive demands, epitomized by Waterloo's Man-Environment Studies curriculum or Notre Dame's courses in philosophy. All elements are likewise conscious, to greater or lesser degree, of an outreach, adult education, or public service mission, however defined, characterized by the University of California-Los Angeles' work with inner-city schools, and the state of Alabama's unique Environment and Energy Education Consortium.

Anatomy

The viable environmental studies program today, whatever its taxonomy or etiology, usually seems to exhibit certain common characteristics. First, it is a budget line item, not a mendicant, although the level of funding may be less than ideal. The University of Vermont's new Environmental Program and New Jersey's veteran School of Conservation are representative of discrete administrative units. Second, the ES program is usually a degree-granting program in its own right, not merely a "concentration" in somebody else's degree, although the credibility of some of the new ES degrees may be suspect, and some piggy-back programs are thriving. Ball State's Natural Resources Program is typical of the degree status. Third, the instrumentality sponsoring the program offers a secure, or at least semi-secure, tenure track for junior faculty, although the heraldic trappings of the conventional disciplines may still be embryo in nature; for example, access to the more prestigious scholarly journals. Huxley College within Western Washington State represents the self-contained faculty. After a decade of mild cold war with established deans and dons, the ES leader is again on easy speaking terms with his campus colleagues, as at Iowa State, where Craig Davis has a large "adjunct" faculty. The ES leader is also establishing effective communications with his counterparts around the country, led, perhaps, by Michigan's William B. Stapp. Their collective penetration of the federal and foundation granting agencies is a mixed bag; Penn State's Center for the Study of Environmental Policy appears to have been particularly successful at tapping varied sources of support.

Morphology

What in fact do environmental studies programs look like today?

At the level of undergraduate education, one type is "Ecology U." The University of Wisconsin-Green Bay, an entire institution custom-constructed

around humankind-environment curricula, or Evergreen State in Washington, fabricated somewhat along the same lines. An intermediate model is St. Lawrence, where a discrete environmental studies unit has found a niche in an otherwise conventional liberal-arts college. A third approach is that of Colorado State's School of Forestry and Natural Resources, which has assimilated environmental studies without much structural change.

With respect to professional training, there are, on the one hand, those programs that represent adaptations of existing advanced degrees, such as the development in economics at Wyoming. On the other hand, there are multidisciplinary programs put together out of whole cloth, like the water resource management master's administered by the ambidextrous Institute for Environmental Studies at The University of Wisconsin-Madison.

At the level of environmental research and Ph.D. production, one model is the problem-oriented approach like UW-Milwaukee's Great Lakes Studies Center. Another model is the more discipline-based approach, such as Illinois' Department of Ecology, Ethology, and Evolution.

Extension, outreach, public service, continuing education--as you will--has likewise several models: Maryland's retooling of ag extension; broad biological and social science outreach, as effected by the University of Washington's Institute for Environmental Studies; professional school public service, as represented by the University of Illinois College of Law's Office of Environmental and Planning Studies; the University of Wisconsin System "merged" approach.

Again, the striking feature is symmetry with diversity, or the other way around, depending on how you view the university animal.

Ecology

What of the interrelationships today among environmental studies programs and their colleges and universities?

Unquestionably, environmental studies have had a measurable impact on the campus. For undergraduates they have offered an air of relevance to the higher learning. For graduate and professional students, they have provided entrees to new careers in both the public and private sectors. For faculty, environmental studies at their best have broken down the ivy curtains that had tended to shroud each discipline and its approach to researchable issues. For administrators, environmental studies have provided a nudge to rethink campus configurations and to explore new outreach activities.

As evidenced by the widespread emergence of discrete courses, programs, majors, centers, and institutes under the rubric of environmental studies or related terms, the environmental movement of the late 1960's and early 1970's has had a measurable impact on college and university organization and offerings across the country. But what is not clearly so evident is the more subtle influence of environmentalism on the warp and woof of traditional schools and colleges within universities, and particularly the solid role of environmentalism in breaking down barriers among conventional disciplines to produce cross-discipline undergraduate classes and graduate research seminars.

While some of that influence may have resulted only in semantic changes in course descriptions and college catalogs, the evidence suggests a reasonably profound and relatively rapid adjustment of substantive offerings to the impulses of the environmental decade. To be specific, at one representative state university, course titles with an environmental tilt have risen in number by 443 percent between 1965-66 and 1975-76, not counting the even more subtle changes in the contents of courses and changes in titles.

In turn, the university environment has had a measurable impact on environmental studies. The innate conservatism of the campus has begun to mute the emotionalism of early environmental voices and substitute a more measured approach to public issues. New "hard" data from laboratory, library, and field are replacing yesterday's educated guesses. The growing austerity on the campus now operates to depress the development of ES teaching and research strengths, and reward-system constraints continue to make it problematic for some junior faculty members who might choose to do so to forsake their conventional disciplines for ES enterprise.

The Essence of Change

In essence, environmental studies have brought to the campus the basic concept that the development of an optimum human environment requires an understanding and an application of the contributions which can be made individually and collectively by all the arts, sciences, social studies, and professions. Quite apart from the organizational adaptations developed to render operational this basic concept, the higher environmental studies seem to have evolved six pervasive themes or "red threads" running through all environmental instruction and research, whatever their particular site or strategy.

Unity

All components of any system are in varying degrees interconnected and interdependent. The integrity of the biosphere--and of humankind as a resident--is dependent upon the intricate balance of many subsystems. So with the global social system. Our concern must be for relationships, interactions, and the effects of various changes in conditions upon related subordinate, coordinate, and superordinate systems--biophysical and socioeconomic. Muir said it: "When we try to pick out anything by itself we find it hitched to everything else in the universe."

Fragility

No social system is immutable. All natural systems have a limited tolerance for perturbation. This concept pertains to the rate and extent at which physical and social degradation is introduced into the environment as well as to the rate and extent at which energy is dissipated, and natural and human resources are exploited or manipulated. Commoner said it: "There's no such thing as a free lunch."

Diversity

Long-term biological and sociological evolutionary processes invariably move toward increased complexity and higher levels of organization. It is by virtue of their diversity that mature natural and built ecosystems are adaptive enough to withstand a variety of traumas without loss of identity. But cultural intrusions of modern man have reduced both local and global ecological variety. The result--a threatened loss of stability to various ecosystems and ultimately to the total biosphere. Leopold said it: "To keep all the parts is the sign of intelligent tinkering."

Quality

Once seemingly efficient technologies and cultures have proven counter-productive in that they fail to function symbiotically with natural systems and human nature. If an environment capable of fulfilling humankind's higher-order aesthetic and humanistic needs is to be restored and maintained, certain value reorientations, some difficult tradeoffs, and some changes in life style are in order. Lincoln said it: "We must disenthral ourselves."

Policy

Resource conservation historically has involved largely private, technological, ad hoc, stop-gap solutions to limited problems. Environmental protection calls for a public decision-making process equipped for surveillance of the total environment and capable of imposing long-range economic, social, or legal sanctions against those elements presenting a threat to the public interest. Caldwell said it: "A positive public policy to protect the human environment is a practical necessity."

Responsibility

The interdisciplinary study of the people-resources-technology system is an inescapable focus of any modern university. Bryson said it: "A university absolutely must turn a portion of its intellectual might towards the critical problems of the environment."

The Future of Change

Are higher environmental studies a fad or a fixture? If anything assures their tenure, it is because they are really indigenous to the American university. The university world does not husband imports very well. Environmental studies are native to the campus.

In the first place, the environmental problem lends itself in part to technological solutions--gross scientific and engineering approaches. American universities are simply very good at big, massive engineering problems. Look what has happened just in the lifetime of adult Americans. We lassoed the mountains and deserts of the West with sinews of concrete and steel. We inundated simultaneously the forces of Fascism on two continents with tons of tanks and howitzers and war planes. We have in turn revitalized whole continents with massive shipments of technological know-how. And more recently, we have gone to the moon, from hindsight, almost as easily as a Sunday drive. We are superb at accepting big technological challenges and licking them. Universities are going to respond in exactly this same way to the environmental problem. It's a natural for campus know-how.

Second, there is an ethical, or moral, dimension to the environmental movement which is also very American. This country was born as a moral movement. We made the conquest of Trans-Appalachia a moral movement. Its real leader was not Daniel Boone but John Wesley. Our great-grandfathers were taken up by an intense moral movement in the 1830's and 40's--the abolition movement. We tend to forget the great clout that movement had as we carried it through to a very bloody resolution. At the turn of the century the prohibition movement swept this country, and again we carried it to a resolution; short-term, yes, but nonetheless a moral resolution. We didn't really start getting out of the Depression until we changed it from an economic problem to a moral movement. That was FDR's signal contribution. When he got up on that dark day in Washington and said, "We have nothing to fear but fear itself," he changed the whole gestalt, if you please, of the country. We made World War II a moral movement as well. Mr. Eisenhower didn't call his after-action report Campaign in Europe, he called it Crusade in Europe. More recently, we made the Marshall Plan not just an economic device but a moral movement. So, in the sense that environmentalism requires changes in standards, requires value judgements, requires, as Leopold said, the emergence of an ecological conscience, it is a moral or ethical movement, with a high survival value on the American campus which has always had an evangelical tradition.

Three factors may operate to negate this prediction.

First, at the graduate level we could see a return to piecemeal researches and regiments that are the antithesis of the environmental perspective. University faculty structures, policies, and practices are not necessarily benign for cross-

discipline programs.¹¹ Junior faculty members particularly may find insufficient security in inter-college appointments with no tenure "home." It will take alert administration to foster the cross-fertilization of scholarship that may well be environmental education's greatest contribution to university enterprise.

Second, at the undergraduate level, where environmental studies are offered as broad education for responsible citizenship, they merit student enrollment and faculty support; but where they are billed as professional programs, they are a fraud on students who will never find entry positions as environmental generalists; consumer protectionism can and should catch up with the guilty colleges. Environmental studies "will be strong to the extent that they incorporate specialization," warns Roderick Nash: "They will be weak if they face the dragon of environmental problem-solving with the blunted lance" of only the "well rounded." The magnitude of the environmental problem "demands the specialist."¹²

Third, environmental studies could die of malnutrition. It is one of the anomalies of history that environmentalism came to the campus virtually simultaneously with a progressive decline in university wherewithal. Rarely have they enjoyed the fiscal support that could have been theirs if they had appeared even five years earlier. Nor have federal or foundation funds been forthcoming in anything approaching the need. It has only been through frugality that environmental studies have sustained themselves. A projected general decline in university enrollments or a freeze on government grants could threaten the continued development, if not the existence, of environmental studies. So could a public backlash against the tough resource management options that are bound to come out of campus laboratories and seminars. Fortunately, according to a recent national poll, "environmental protection has been transformed into a popular institutionalized movement that shows little sign of abating, even during a period of economic stress."

What is not beyond the realm of possibility in the future is a great environmental cataclysm, very real and very widely perceived, that will energize Americans and all people in the manner of the Great Depression and World War II, and bring society crying to the campuses for help. We need a strong base of environmental studies in the universities in order to be prepared to respond effectively to any such calls.

There may be vociferous arguments over timing and degree, but there is little argument today that our world of tomorrow will demand, on the one hand, a less destructive technology and on the other a less consumptive life style. (That there is such little argument over kind can be attributed, by the way, to effective environmental education at all levels.) Given competent, dedicated personnel and adequate funding, environmental studies programs in colleges and universities can certainly contribute to the discovery and application of more benign technology. Whether they can contribute to a more conservative American life style is a real question.

It is not that environmental studies people do not talk a good conservation ethic; they do. It is simply that the typical university environment is the antithesis of the resource-saving that may be called for. Highrise air-conditioned residence halls with windows that can't be opened, acres of blacktopped parking lots in the absence of mass transit, no light and heat discipline in classrooms or labs, students celebrating TGIF as if there were no tomorrow, professors jetting themselves around the globe to manifold learned meetings, echelons of vice chancellors still preaching the gospel of growth, alumni demanding it--at least on autumn Saturday afternoons: all this is hardly conducive to the inculcation of a more frugal standard of living.

¹¹ Levensky, Mark. 1977. "Trying Hard: Interdisciplinary Programs at The Evergreen State College." Alternative Higher Education, 2(1): 41-46.

¹² Nash, Roderick. 1977. "Goodbye Renaissance Road," The Journal of Environmental Education, 8(4): 2-3.

Perhaps what we need is an experimental second-generation environmental studies program, a prototype of the spartan campus that tomorrow may require. The model is easy to delineate.

A dormitory open to the winds in summer, in winter heated by individual pot-bellied stoves in each room, the fuel harvested from campus woodlots. No private vehicles. Lights out at taps. The weekend feature the Thespian Society play. Faculty confined to train rides. Vice chancellors absent. Alumni leading prayer meetings instead of pep rallies.

Weird? That is an accurate paraphrase of John Muir's account of his freshman year at the University of Wisconsin in the 1860's. One would be hard pressed to say his austere environment depressed young Muir's lilting spirit. Far from rendering him a knight in search of affluence, it made him the first major custodian of our natural wonders. It would at least be interesting to see what a John Muir Experimental College of Environmental Ethics might accomplish in the 1980's.

Yet it is unrealistic, of course, to contemplate a precipitous mass retreat to the leanness of the mid-19th century campus. Such a retreat could not be effectuated short of a political dictatorship that would be at least as evil as the disease of environmental degradation. Given the growing insights of environmental scientists and engineers, such a retreat should not be necessary. But those same scientists and engineers will be hard pressed to achieve a sanative development of available world resources in the absence of a change of pace in resource husbandry and consumption.

Until now we have done only what was easy, or what government could do, or both. We have not really confronted the profound changes in interdisciplinary science and individual life style the environmental imperative may demand. The greatest successes of the federal Environmental Protection Agency so far, for example, have come from applying existing technology to specific sources of emissions and effluents; still to be introduced--and far more difficult--are pollution control measures that involve real changes in American life styles and land-use patterns.¹³ It could be we will be saved only by profound research applied to environmental needs, coupled with a hippy-type culture with a haircut, as it were, a culture composed of fewer additive consumers and compulsive wasters, yet one retaining the luxury of indoor plumbing.¹⁴ We must believe it inconceivable that a country which has passed from Depression and global war to putting men on the moon cannot somehow discover the technological and philosophical insights that will preserve the human animal in some state of reasonable harmony with his fellow passengers, great and small, on their mutual spaceship. A reasoned optimism is a requirement for progress. To take undue counsel of our fears is to court defeat.

Unquestionably we need continued and continual reshaping of education at all levels if humankind is to survive in the sort of world that is fast evolving, what Eric Ashby calls "education for insecurity" in a global society "wired together so tightly that a short-circuit can fry us all."¹⁵

The continued success of the environmental effort in the United States will depend on three things, says Train:¹⁶ our ability and willingness to find ways of

¹³ Train, Russell E. 1977. "The Beginning of Wisdom." The Wilson Quarterly, 1(4): 93-104.

¹⁴ Arnsdorf, Val. 1975. "A Report of the Nature and Status of Environmental Education." In Current Issues in Environmental Education-1975, Columbus, Ohio: ERIC/SMEAC.

¹⁵ Ashby, Eric. 1974. Adapting Universities to a Technological Society. San Francisco: Jossey-Bass.

¹⁶ Train, op. cit.

keeping costs, inequities, and inefficiencies to a minimum and of encouraging constructive reconciliation of environmental, social, and economic goals; second, the effective redirection of the environmental effort to ensure a steady shift from the control of pollutions to their prevention; and third, the strength of the general public's commitment to environmental protection--which leads us back to environmental education and its effectiveness or non-effectiveness.

Several skills are needed by professors and students in environmental studies, Robert Good says:¹⁷

1. Skill in the analysis of complex interactive systems, long-term effects, linkages of factors, and the worldwide consequences of local decisions and actions.
2. Skill in the historical analysis of the human perceptions, attitudes, and ideologies that can complicate the application of scientific knowledge to the solution of environmental problems in differing economic and political systems and in differing cultures.
3. Skill in the analysis of values and in rendering moral judgements; in recognizing, for example, that growth and progress are not necessarily synonymous.
4. Skill in personal involvement in problem-and policy-oriented interdisciplinary action befitting a literate citizen of a beleaguered planet.

Selected environmental studies programs suggest a variety of ways and means by which university teaching, research, and outreach can help meet a national need for environmental data, doctrines, and action.

¹⁷ Good, Robert C. 1977. "The Twenty-First Century is Now." Educational Record, 58(1): 18-30.

COORDINATION OF LARGE INTERDISCIPLINARY RESEARCH PROJECTS

James W. Jondrow and James L. Clapp¹

Large interdisciplinary research projects within a university require major efforts in coordination if their full value as education is to be obtained and their objectives are to be achieved. Work on research emerging from community or national needs aids the graduate student by providing a stimulus for focus on relevant problems, by introducing the student to some of the realities of non-academic work, and by offering the opportunity to receive pay for preparatory work in the field of specialization. It may also provide an integrating experience encompassing the separate disciplines in a wider framework. But this latter value may be lost if the interdisciplinary research is not carefully coordinated.

The specific goals of coordination are: 1) To match the capabilities of the research team to the necessary tasks, 2) to establish and maintain project momentum consistent with the urgency of the research objectives, 3) to achieve research objectives.

The projects with which we have had experience in the Institute for Environmental Studies at the University of Wisconsin-Madison are, for the most part, interdisciplinary: in environmental questions, everything seems tied to everything else. Since these projects are interdisciplinary, they tend to be large. A typical project costs \$2 million for three years, and has 25 faculty members from 18 different University departments. Thirty graduate students, ten full-time technicians, and about 40 other students complete the research team. Because this research is funded primarily by state or federal government with the purpose of aiding the work of regulatory or planning agencies, the objectives are usually practical and the results urgently needed. Typically, potential users anxiously await successful results.

Because the projects are interdisciplinary and the users need the results urgently, the tendency to fragmentation is strong, with individuals concentrating on the limited areas familiar to traditional disciplines. Project participants feel pressure to settle for more immediate goals that do not require the time it takes to develop genuine interdisciplinary results. Changes in sponsoring or user agencies may obscure objectives or even switch them in mid-stream. If these threats to the integrity of the approach and the mission of the project become too strong, the educational experience of the student may be one of fragmentation and extreme frustration. Although these may be a valuable learning experience because they represent real-world conditions, they may distort what progress the student makes toward environmental education.

The investigators in the projects with which we have had experience intend to make the research an integral part of a graduate (and undergraduate) educational experience in environmental or related studies. Although at the University of Wisconsin-Madison there are many variations in a graduate student's academic program leading to a Master's or Doctor's degree, a typical program will include two major components: academic course work and research.

The length and intensity of a graduate student's participation in a research project depends on the student's goals. Typically a candidate for a Doctor's degree will devote three or more years to research on a topic that will be the subject for his or her thesis. The research must include an original contribution to scholarly work in this area and must be reported in a dissertation, formed and written according to the standards of the Graduate School of the University and the faculty members of the individual's degree committee. When the research

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requirements are met, the committee must approve the thesis by means of an oral examination.

Usually graduate students will be advised in the research work by their professors, who will be participating investigators on the interdisciplinary research project. In some cases, however, if graduate students undertake research as part of a large project in which their major professor has little or no participation, a research advisor provides guidance. Graduate students working as research assistants on a project are paid as half-time workers for a period of approximately three years. The intensity of the relationship between a graduate student and the research advisor during this period will vary, but almost daily contact is maintained.

We wish to speak about some of the forces coming to bear on the educational experience of graduate students as a result of the character of the large interdisciplinary project, the project's tendency toward fragmentation or shifting objectives, the nature of the student's academic experience, the focus on the requirements of the student's discipline-oriented committee. We have observed several kinds of mismatches producing problems we would like to be able to alleviate.

I. Mismatch of Funding Agencies

The experience of a graduate student on any research project may be interrupted because of a mismatch between the objectives of the funding agency and those of the student. This is particularly true of those students whose research objectives include examination of broad environmental and policy aspects of a problem. Mismatches occur more frequently in large interdisciplinary environmental research because the missions of funding agencies typically are limited to portions of the total problem. Rarely is the mission of a single agency broad enough to encompass all the components of a real world environmental problem. The effect of this mismatch on the graduate experience may become critical if it is not recognized before students have committed significant portions of their graduate experience.

For example, a student is working on part of a project funded to determine the optimum procedure for siting electric generating stations. In the view of the student and his advisors, the problem must be seen as an investigation of all the possible mixes of demand with type of generating station which would meet the need. As the research develops, the funding agency discovers it had assumed that the primary relevant question in the siting of generating stations was the establishment of air and water standards. Its own bureaucracy questions funding of research that moves outside the objectives of the agency. The move is made to cut off the funds for the research when the student has already committed a substantial portion of his research time. Successful progress in the degree program is dependent upon the student's seeing the research through to the end.

The University makes every effort to assure that the research work of graduate students is not prematurely interrupted, but heavy dependence on federal funds for the support of graduate student research makes this difficult. In our experience some federal agencies have recently become much more constrained by their particular objectives as organizations, and much more intense in their attempt to prescribe the exact limits within which research will take place.

The problem, when it emerges, may be difficult to recognize since pressure from the funding agency in a large interdisciplinary project comes to the Principal Investigator or Project Leader who must be sensitive to communications from the funding agency. On the other hand, the graduate student, and usually the major professor, see the situation from the perspective of the academic research of the student. Their tendency is to see this as an intrusion into academic freedom and to resist external pressure to modify the research directions.

If this problem is encountered after the research is well under way, the only

solutions seem to be either great patience on the part of the funding agency, great versatility on the part of the student, or willingness of the University to use other funds to complete the research.

There appear to be two methods of reducing or eliminating the effects of the mismatch. First, it is better and more realistic to try to eliminate the problem through steps aimed at prevention before the project is under way rather than to try treatment once the problem has shown itself.

A period of careful discussion and the study of research objectives before firm commitments establishing the components of the project have been made may go far toward alleviating this problem. Discussions should include representatives of both the funding agency and the research team. They should take place before the final research team has been formed and over a long enough period to allow action and reaction between the researchers and the funding agency. Usually, at the beginning of questions about the objectives, parties will be so clearly guided by their own presuppositions that they will not realize that the same words may have an entirely different meaning to others.

In specifying the objectives of research it is important that those writing proposals and formulating work plans do not assume that objectives are merely a bureaucratic exercise having no "real world" significance. Conflicts between different understandings of what research should be are better fought out in preliminary discussions than in attempts to revise the course of research after much has been invested in its progress.

A second approach to this problem is for the University to seek funding from a variety of agencies whose composite mission is broad enough to encompass the scope of the environmental problems. Although this approach seems attractive, the day-to-day realities of generating and operating multiple projects with multiple funding agencies in an integrated fashion tend to be overwhelming. It is somewhat naive to attempt to organize government bureaucracies from the campus. Nevertheless, upon occasion, funding from several agencies can be combined to achieve a broader focus of research. The opportunity of the graduate student to explore the broad scope of real world environmental problems and their solutions may thus be provided and protected.

Since both methods of reducing the impact of mismatch of funding agencies require significant periods of time, the solutions may lead to a second type of mismatch, the mismatch of time frames.

II. Mismatch of Time Frames

The urgency of environmental questions and the need to build relationships among different parts of a project may cause a serious mismatch with the time frame in which graduate students normally accomplish their research work. Typically, doctoral students take three or more years completing their research. During an initial period, they familiarize themselves with their specific subjects, search the literature to gain breadth in the field and develop some necessary skills for the work. (Often the skills are not those natural to a student's discipline.) Finally, they begin the actual research. If the data-collection phase of the research takes about a year and the analysis and interpretation of results another year, three years may be a minimum time for such an endeavor.

A reading of Commerce Daily seems to indicate that most "Requests for Proposals" for research dollars coming from federal sources specify a completion time of from 9 months to 18 months. This is only part of the problem. In many cases, research projected and approved on a three-year time table becomes so urgent that the funding agency and users are anxious for results after only eight or nine months.

For an example at Wisconsin, a group met for eight months developing their understanding of how research should be structured to study the question of power-plant siting. About a year after these discussions began, a three-year

project was funded with completion predicted by 1978. That is, four years would elapse from the beginning of discussions until the first projected conclusions. At the same time public utilities were feeling pressure to begin the construction of electric generating stations to meet anticipated peak demands and to speed the conversion from oil fuel to coal. In the State of Wisconsin an additional electric generating station capacity of 7,500 megawatts has been proposed for use by 1990. Of this total, the siting of 6,100 megawatts capacity, could not be affected by the conclusions of the study because the actual decisions would have been made prior to completion of the research.

If the time frame for the research could have been shortened by one year, a larger potential impact on the problems in siting power plants might be anticipated. But several kinds of factors limit the extent to which the time frame can be collapsed. First, in many cases one portion of the total problem must be studied and some results reached before it is possible to proceed in a related area. These pieces cannot be run concurrently. Second, the building of a team for interdisciplinary research requires a period of time. Usually investigators who have not worked together before will require from six to 18 months of mutual experience before they are able to function efficiently in interdisciplinary projects. Third, the natural rhythm of the academic year, to which the graduate student is tied by the demands for satisfaction of academic requirements, frequently restricts the flexibility of design of a major piece of research.

The urgent need for results tempts the project leadership to promise quick conclusions and puts irresistible pressures on the research advisor and the graduate student to meet impossible deadlines. While in many cases this may represent a "real world" condition to which it is good to expose a graduate student, the dilemma raised by this situation should not be left unexamined nor should it be assumed that everyone draws the same conclusions from the tensions that exist.

A great deal can be done about tensions resulting from differing time frames if the problems are anticipated early enough. Matching time frames must be a subject of careful investigation before the project begins. If however, it is encountered only after the project begins, the understandings of the time frame for different parts of the research must be realistically clarified among both researchers and sponsors of the research.

The attempt to examine in advance the expectations of sponsors and the time table of components of the research may involve us in another time frame problem. It is a desirable educational goal to include participation by the graduate student, especially the Ph.D. student, in the design of the research. But an investigation before the project begins can require periods of time which significantly extend the graduate student's tenure on campus. This is particularly true in large interdisciplinary projects in which relations among components are complex. Further, it may happen that after this careful examination of time frames is made, the work may not be funded. The student must then search for an alternative research topic, or obtain funding from another source. Obviously, this will also result in costly delay.

III. Mismatch of Expectations for Non-Research Services

Requests for proposals for research in the environmental area often call for work which is a mixture of original research and repetitive services. For example, in research on a coal-fired generating station it was necessary to secure on-site or near-vicinity meteorological data. These data would be used by several other components of the research in models for diffusion of plumes in the air and the resulting deposition of pollutants. Initially, original research was necessary to determine the best methods for securing the needed meteorological data at a scale appropriate to these uses. Once this initial phase was completed, however, the meteorological activity needed was the continual monitoring of the area of research to produce several uninterrupted years of data of wind direction and velocity, precipitation, and temperature.

While the continual monitoring of an area was recognized as vital to the research, this is not the kind of work to which a graduate student can be appointed as part of his academic program. Graduate students who find themselves facing only a monitoring chore see their academic needs being neglected. If this problem is anticipated at the outset, it is possible to set up a monitoring program in such a way that it does not involve graduate students, or involves them in ways not directly related to their research work. However, often it is not clear at the outset of the project whether a particular function will produce original research or resolve itself into a continual monitoring function. Further, when graduate students are employed to perform vital service functions, experience indicates that when faced with choices involving their own research and their commitments to the project, they must choose in favor of their own educational experience. Although this is as it should be in view of the overall mission of the University, it can create significant problems for the project.

It has been our experience that, in general, our University research teams, facilities, and institutional arrangements are not well designed for long-term, continual monitoring operations. Our first line of defense against this problem is to avoid projects that have as their core continual monitoring or production of large amounts of repetitive data. On the other hand, a certain amount of this activity is necessary for any environmental research. We would try to reduce the problems for graduate students by using permanent employees, technicians or specialists, to meet this need.

The existence of long-term monitoring services may be of great interest to graduate students. The understanding of how they function could well be a part of their education experience. However, in our opinion, this is not the kind of activity that properly should be the central focus of work by graduate students.

IV. Mismatch of Breadth and Depth

The education of students in the environmental area is a balancing act between the demands for breadth and the demands for depth. While students must plumb deep enough in their studies to be masters of their particular disciplines, they must be broad enough to see their fields in proper context. Environmental problems tend not to match customary academic boundaries, as understood by many universities. Environmental problems are usually much broader. In addition, the dilemmas faced by many potential user agencies add other dimensions that may require even broader views of the problems.

For example, consider a graduate student who delves into a current problem of land-records systems. He produces a masterful dissertation as a result of his study. But it includes, in addition to work in his home discipline--engineering--much that is a study of history and of political institutions. His research topic had been developed with remarkable depth. But it required him to step outside the boundaries of one discipline and venture into other fields. This makes it difficult to define clearly his academic task. A traditional academic committee might well ask whether a graduate student should reach out so far beyond his primary discipline in graduate work. Strong arguments can be made on both sides.

In the past, students at the University of Wisconsin-Madison who wanted to study environmental monitoring found themselves at odds with academic committees. The breadth of the education required by the subject resulted in preparation different from what would have been dictated by the customary depth required in each academic discipline.

Recently, however, a graduate degree program in this area has evolved, based on new requirements for the graduate student. These new requirements differ from those of the related disciplines; they involve several disciplines in an individual program. Further, the student's academic committee is made up of faculty members from each of the relevant disciplines. The structure of this academic program is intended to match the requirements made on researchers undertaking study of questions on environmental impacts, since this kind of research regularly

involves participation in several disciplines at one time.

We believe that the solution to this tension between depth and breadth should not be found in completely emphasizing either alternative. The tension between these two dimensions should--and will--continue. However, as a result of pressures created by questions about environmental impacts which require an approach to whole ecosystems rather than to small discrete parts, the balance will probably shift toward greater breadth, at least for some students. More time may be required, however, for the preparation of students in this area, since it is probable that a reduced emphasis on depth will not be appropriate. Depth will be required as well as breadth.

V. Mismatch With Audience

If one were to engage in pure research, pursuing "knowledge for its own sake," the audience or user of the results of the study would not be important. Environmental research, however, is usually focused on the application of human knowledge to the solution of "real world" problems. The problems tend to be urgent and potential users waiting for results are clearly identified. This is not a familiar context for university research, which has been guided by the image of free pursuit of knowledge in order to understand reality, without the constraints imposed by attention to the audience.

The graduate student involved in environmental research will face tensions generated by the anticipated user of the results of the research. Consider the case of a student who is expected, under the terms of the project, to produce a manual to enable a state agency to use the study's results. The manual produced has scholarly elegance. It contains derivations of the equations used and explains most of the technical details involved. But the state agency receiving the manual actually expects one that will explain in clear, practical language how to use the result. Under the conditions, the manual will not seem to provide the information the agency wants.

In this case, the work of the student is good and probably the material prepared will be of use at a different level in the state agency. However, this person cannot help being affected by the obvious mismatch between the expectations of the agency and his expectations in this project.

One could question whether it is appropriate for the graduate student who is supposed to be demonstrating the capability for original research to be writing a manual that is expected to have practical application. For most graduate students, to produce a good, working-level manual would require the development of an extra communications skill, although some could do an excellent job at this through natural ability. It is not unrealistic to consider that the development of skill to communicate the results in a way that will make them useful to technicians should be an integral part of environmental education. It has been found in many cases that solutions to problems cannot be immediately applied because they are structured in formats or terminology that the appropriate agency cannot use. "The truth" sometimes does not make an impact without some help.

In the real world, environmental questions may involve not only regulatory agencies but citizens' environmental groups. The graduate student who would expect from his academic experience that his most important task is to prepare an article that will meet the standards of a scholarly journal, may need to know also that communication of his results at a different level, for different purposes--depending on the audience--may be equally as important.

A mismatch of audiences is more easily prevented than it is cured, once it is encountered. But once the problem is clearly recognized it can be solved. At the outset of research, especially where federal agencies, state agencies, environmental groups, or industries involved in environmental questions are concerned, attempts to understand the relationship of the results to the user should be made. A part of the subject matter with which the graduate student should become familiar is the relationship of the results of this research to various potential users.

Potential Users

As an alternative approach on large projects, specialists in manuscript preparation may be hired to "translate" the scholarly journal product into a format more compatible with an identified audience. If this approach is used, the manuscript specialist must achieve and maintain close working relationships with both the researcher and the audience.

Conclusion

The five types of mismatches detailed above are variations on one theme: a mismatch of objectives. It is important in environmental research conducted in a university to achieve the best possible match between the objectives of the research as perceived by the funding agency and the user agencies and as perceived by the university. Early anticipation of the problems that may come from a mismatch of objectives will often lead to solutions. But this requires attention to many details before a research project actually exists; attention to some broad details which may be larger than the confines of the project, while it is in progress; and attention to follow-on activities after the project is finished. The coordination and management of these relationships will aid in relating the "real world" field of environmental research to the academic climate of the graduate student.

Some of the activities necessary for the solutions of these problems are outside the normal confines of any one project. They require that a separate--and usually separately funded--core organization be available to carry out certain important tasks:

1. Develop teams. Teams need to be built carefully to conduct interdisciplinary research. The 6 to 18 months usually required to bring several researchers together to work efficiently in an interdisciplinary mode may be a time when they need stimulation and help in working out communications. While some of this development of skills needs to be done in the context of the project, part may be done before a project is under way. Help may be needed also to replace a team member who leaves the work, since a break in the team may be critical.
2. Plan approaches and proposals. The suggested solutions to many of the problems we have seen require a period of planning before proposals can be finished. The task of keeping momentum in these initial phases of discussion and planning can be aided by a more permanent organization.
3. Link projects. The goals of some environmental projects are too broad to be funded by any one agency. In recent years, state and federal agencies appear to be under increased pressure to confine their work to clearly limited missions. This means that any one agency can fund only pieces of an investigation. For a broad view of the solution to such a problem, someone needs to bring together the results of several projects, or bring the research teams into close proximity. A permanent core group could serve this function.
4. Collect and make research results available. Long after a project is completed, the results, and sometimes the data, need to be available for communication to other research teams or users. This is generally outside the control of a particular project team. A longer-term group is needed. For example, it could structure and maintain a data bank in such a way that it can be effectively used by other researchers. It could also explore the channels of communication to potential user groups not yet aware of the research.

While these coordination functions are focused to make the research more effective and useful, they will also provide those conditions within interdisciplinary projects that will improve the experience of the student who has a part in the work.

ENVIRONMENTAL EDUCATION RESEARCH

Papers in this section represent learning research in K-12 environmental education. They ask, What sorts of instructional programs or specific teaching-learning strategies produce what sorts of learner outcomes, and why? They constitute a variety of approaches, from "pure" to "applied" to "informal." Two papers use rather tightly controlled experimental designs to examine the effectiveness of specific teaching strategies. Lei Burrus-Bammel and Marlene Hanson use one brief experimental treatment while Mary Hepburn uses three different treatments over a somewhat longer time frame. Two papers deal with innovative school district programs. Fred DeLuca, *et al.* examine many variables in evaluating a program which has been in place for several years. Karen Hollweg's paper is primarily a program description, but she includes encouraging results of informal program evaluation. (It should be noted that the issues examined by students in this program are not all environmental or ecological issues.)

Research results presented by Louis Iozzi are particularly stimulating. He develops, validates, uses, and describes new work which will use an Environmental Issues Test based upon Kohlberg's stages of moral development.

PUPPETRY AND ENVIRONMENTAL EDUCATION: A RETENTION STUDY

Lei Lane Burrus-Bammel¹ and Marlene Hanson¹

ABSTRACT

Twenty seven (27) fourth grade students were subjects in a study that was designed to determine whether or not puppetry would be an effective means of communicating an environmental message.

A pre-test post-test control group design with a retention test three weeks later represented the experimental procedure. The independent variable was the teaching method, puppetry for the experimental group and traditional lecture for the control group. Knowledge and attitude were dependent variables.

Resulting knowledge data were analyzed by a paired "t," attitude scales by chi-square. The puppetry group was significantly (.05) higher on the knowledge post-test, administered immediately after the treatment. However, no significant difference was found on the retention test administered three weeks later, although both groups still varied significantly from the pre-test.

INTRODUCTION

The evolution of environmental education methodology has paralleled the stages of science teaching: identification, collection, experimentation, exploration, and observation (16:7-8). This, however, does not seem to be the most propitious strategy for establishing needed innovative instructional ideas. A Presidential advisory group for environmental education (13) as well as Galushin and Doraiswami (5), indicated a need for new and interesting methods. Puppetry, one of the oldest art forms, has been said to constitute an international language (3). Therefore, a study was designed to determine whether or not environmental education programs could be taught through puppet presentations.

REVIEW OF LITERATURE

One common denominator in life is the universality of play (12:3). Play has also been recognized as the major medium of learning for children (7). As early as 1915, John Dewey was concerned that few people had experimented with natural play activities in a classroom situation. That same year, the use of puppetry in education was considered. Lee commented that "a true educational experience is possessed by play and, to the full extent, by play alone... Play is thus the essential part of education" (8).

The 1968 report of the Commission for Economic Development expressed concern that too much instruction utilized the lecture method and recommended greater experimentation with alternatives. Reported investigations, however, have failed to indicate that alternative methods such as simulation, gaming, creative dramatics or storytelling were significantly different from conventional or traditional methods of instruction (1, 4).

A resource manual to aid elementary teachers in using puppetry in the classroom was developed in 1952 (17), representing the first graduate study at Penn State conducted on puppetry. The specific needs of children which could be met by puppetry are the following:

1. A friendly atmosphere
2. Improves children's coordination
3. Improves creative expression
4. May meet both student and teacher's need to reach educational goals with greater ease
5. Can motivate for the activities:

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- A. Reading
- B. Writing
- C. Listening
- D. Speaking
- E. Historical research
- F. Music appreciation
- 6. Develops ability to understand group dynamics
- 7. Develops positive attitudes
- 8. Provides a means of expressing feelings, yet a means of remaining anonymous
- 9. Creates a need for clear pronunciation and enunciation
- 10. Enables child to become involved in dramatics
- 11. Puppets meet the need for fun and serve as a worthy use of leisure.

In 1975, Bennett pointed out that very little hard data had been gathered to determine the resulting effects of various environmental education programs. Not one of the 117 abstracted studies in Research in Outdoor Education correlated knowledge and attitude nor reported attitude or knowledge change over various time periods. In her opening remarks on "The Dynamics of Research" for the National Research Workshop, van der Smissen commented that "there need to be more studies concerning retention; how long does a 'peak' experience have impact?" (15:14).

PROCEDURE

A pre-test post-test control group design with a retention test three weeks later represented the experimental procedure. The teaching method, puppetry for the experimental group, traditional lecture method for the control group, was the independent variable. Knowledge and attitude were dependent variables. Both instructional presentations were based on the same lesson plan, which illustrated the interrelatedness of people and nature. The term environment was discussed as well as the niches that ants, bees, earthworms, and people occupy and share. Each presentation included the use of a poster board with the words: Environment, Head, Thorax, Abdomen and a large drawing of an ant. The hypothesis was that puppetry would be as effective as traditional teaching methods for environmental education instruction.

Subjects consisted of 27 fourth grade students, male and female, from two classes at Suncrest Elementary School, Morgantown, West Virginia. A toss of a coin decided which class was to receive which method. The control group (N=13) received a 15-minute traditional verbal presentation at 9:15 a.m. and 30 minutes later, that same day, the experimental group (N=14) received a 15-minute puppet presentation. Extraneous variables of teaching personality, novelty of having a different person in the classroom, etc. was controlled by having the same individual present both methods. The advantages of controlling these factors seemed to outweigh the slight disadvantage of different presentation times.

The total test consisted of 10 questions; the first 7 were directed at knowledge, while the remaining three were attitude indicators (attitude being defined as the favorable or unfavorable response toward a statement, event, or class of objects). Knowledge questions were both of a true-false and multiple-choice nature with pictorial options for the attitude questions (Figure 1). Lewis demonstrated that pictorial attitude scales were successful with primary age children (9).

9. How would you feel about killing a honeybee?



Figure 1. Pictorial Attitude Scale.

RESULTS AND DISCUSSION

A paired "t" test was utilized to analyze questions 1-7 (knowledge), and chi-square for the remaining three attitude scales. The two groups did not vary significantly on either part of the pre-test which allowed the null hypothesis of no significant difference between the groups to be accepted. Knowledge scores did improve significantly (.01) for both groups on the post-test with the experimental group (puppetry) being significantly (.05) higher than the control (Figure 2., Tables I and II). There were no significant differences within or between the groups for the attitude questions. Knowledge retention data, gathered three weeks after post-testing, indicated that both groups still varied significantly (.05 experimental, .01 control) from their pre-test scores and that the previous post-test between group difference no longer existed (Figure 2.). This would suggest that each method had the same relative effect on the students and might be beneficial for conveying environmental information to fourth grade students.

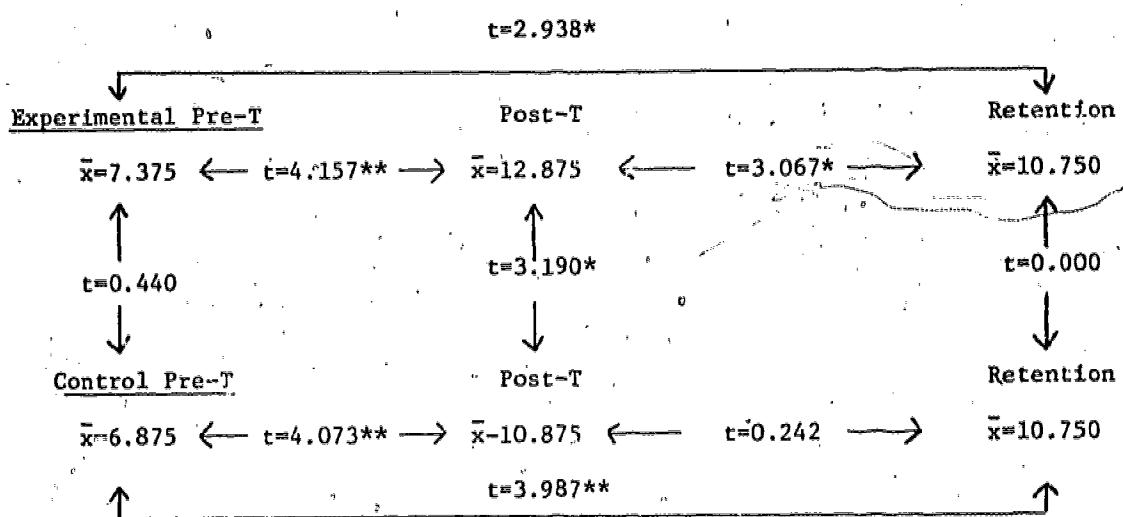


Figure 2. Between and Within Group Knowledge Scores

TABLE I
WITHIN GROUP PAIRED "t" TEST KNOWLEDGE SCORES

	\bar{x}	SD	\bar{x}	SD	Mean D	"t"	df	Sig.
Experimental Group	Pre-test		Post-test					
	7.375	4.657	12.875	1.457	5.500	4.157	7	**
Control Group								
	6.875	3.440	10.875	1.642	4.000	4.073	7	**
Experimental Group	Post-test		Retention					
	12.875	1.457	10.750	2.866	2.125	3.067	7	*
Control Group								
	10.875	1.642	10.750	1.669	0.125	0.242	7	
Experimental Group	Pre-test		Retention					
	7.375	4.657	10.750	2.866	3.375	2.938	7	*
Control Group								
	6.875	3.440	10.750	1.669	3.875	3.987	7	**

** Significant at .01 level, 7df 3.499
* Significant at .05 level, 7df 2.365

TABLE II
BETWEEN GROUP "t" KNOWLEDGE SCORES

	\bar{x}	SD	\bar{x}	SD	"t"	df	Sig.
	Experimental (N=13)		Control (N=14)				
Pre-test	7.375	4.657	6.875	3.440	2.64	14	
Post-test	12.875	1.457	10.875	1.642	2.576	14	*
Retention	10.750	2.866	10.750	1.669	0.000	14	

*Significant at .05 level, 14 df 2.145

Several factors could account for the insignificant or non-functioning value of the attitude questions. Rokeach postulated that attitudes are "a relatively enduring organization of beliefs about an object or situation predisposing one to respond in some preferential manner" (14:134). Therefore, a short, 15-minute presentation absent of fear messages might not be powerful enough to alter the organization process that determines attitudes. Research indicates a positive relationship between intensity of fear arousal and amount of attitude change (10:204). Marler concluded that "the most effective approach the conservationist can take is a negative, punishment-oriented approach" (11:52-53). Another possibility is that the questions might have been ambiguous, either in content or form. Some students were baffled by receiving a pre-test, an identical one for the post-test, and being requested not to sign their name to either. This was obviously not a "normal" classroom procedure.

There were, however, certain limitations. The subjects did not represent a random sample and their degree of cooperation was not strictly controllable. The fact that the test was not standardized with reliability and validity coefficients might be a weakness.

Recommendations for further study would include involving greater numbers, varying the age or grade levels, determining the relationship between intelligence level and various instructional methods, extending the retention time, increasing the presentation duration, and including more than one puppet session for a unit of environmental material.

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ENVIRONMENTAL KNOWLEDGE AND ATTITUDE CHANGES IN A HIGH SCHOOL PROGRAM OF INTERDISCIPLINARY SOCIAL STUDIES AND SCIENCE EDUCATION

Mary A. Hepburn¹

Environmental Education for Secondary Schools (EESS)², a curriculum project at the University of Georgia in 1975-76, sought to produce competencies in environmental problem-solving and positive changes in environmental attitudes by integrating courses of the ninth and tenth grades. The program was based on an assumption that to effectively make informed decisions about environmental issues, students require specific knowledge and skills from both the social studies and sciences. Such interdisciplinary education for environmental problem-solving has had numerous advocates in the environmental education literature (Dean, 1970; Tanner, 1970, 1971; Stapp, 1972; McInnis, 1972; Altman, 1972, Hepburn, 1973; Chalecki, 1974; Tanner, 1974; Hepburn and Simpson, 1975; and Kirman and Nay, 1975). EESS sought to develop and pilot test a workable model for cross-departmental interdisciplinary environmental instruction in the high school.

The project's instructional approach was to combine solid groundings in scientific knowledge with skills in social issue analysis to produce cognitive gains and attitude change. The curriculum modules involved mostly cognitive learning activities with some value analysis interspersed through them. Local environmental issues were highlighted to arouse student interest and increase involvement, but broader, universal application was also encouraged.

A number of environmental educational researchers have postulated that increased environmental knowledge and skill will produce positive attitude changes (Steiner, 1973; Howell and Warmbrod, 1974; Moyer, 1975; Q., 1976). However, the results of the research are generally inconclusive or negative. One facet of the EESS Project was to investigate the effects on attitude of social studies and science modules with their strong local focus.

The Gwinnett County School District, located in a rapidly growing suburban area of metro-Atlanta, was a cooperator to the project. Its largest high school served as the pilot test site for the curriculum modules. Information and viewpoints were drawn from throughout the county-wide school district to provide for local application of environmental concepts.

DESCRIPTION OF MATERIALS AND TREATMENT

The project produced a coordinated set of modules (one for science and one for social studies) for both ninth and tenth grades. Each module stressed the content of its subject area, but was interdisciplinary in application. The four modules each contained a student book, teacher's guide, slide set, audio tapes and supplemental maps and booklets. Readings and activities in the modules were mostly aimed at teaching knowledge and skills, but some value analysis activities were contained in each module. Each module was designed for approximately 15 class days.

The coordinated instructional modules for ninth grade were prepared for use in geography and biology courses taught to the great majority of ninth grade students (i.e., those considered to be in the low-average to high-average range). The materials focused on rapid population growth and the attendant issues of land use planning, waste recycling and pollution. Their readability level by the Dale-Chall formula was at ninth grade.

The tenth grade modules were prepared, at the request of teachers in the school district, to meet a need for materials for "slow learners" who were the low performing students for whom special courses were offered. The written materials

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²Environmental Education for Secondary Schools curriculum development project was initiated in 1975-76 with support from a grant from the U.S. Office of Education. Project staff were drawn from the Departments of Social Science Education and Science Education at the University of Georgia. Dr. Hepburn served as Project Director.

were at the seventh grade level on the Dale-Chall readability test. These modules were prepared for integration into the action chemistry course and the "A-level" American history course taught for slower students. The topical focus on the tenth grade materials was water problems including sources, usage, pollution, treatment methods and flood problems.

The implementation plan was based on the assumption that it would be more effective to work within the existing curricular framework than to attempt to change the departmental structure or expand the program of studies with several new courses. The project sought to initiate interdisciplinary instruction by joint planning and coordinated teaching in the science and social studies departments. The modules were taught by teachers in the social studies and science departments as a part of their regular courses. The same environmental issues were studied in science and social studies at each grade level, but each module highlighted the information, skills and perspectives of the specific subject area in which it was taught. (See Figure 1.)

THE PILOT TEST DESIGN

In the spring of 1976 the newly developed instructional modules were taught to intact ninth and tenth grade social studies and science classes in four test groups as follows: 1) a group which studied the science module only, 2) a group which studied the social studies module only, 3) a group which studied both the social studies and science modules, and 4) the control group or a group of students who received no environmental instruction. Instruction with each module ranged from 15-17 class days.

Table 1

TEST DESIGN

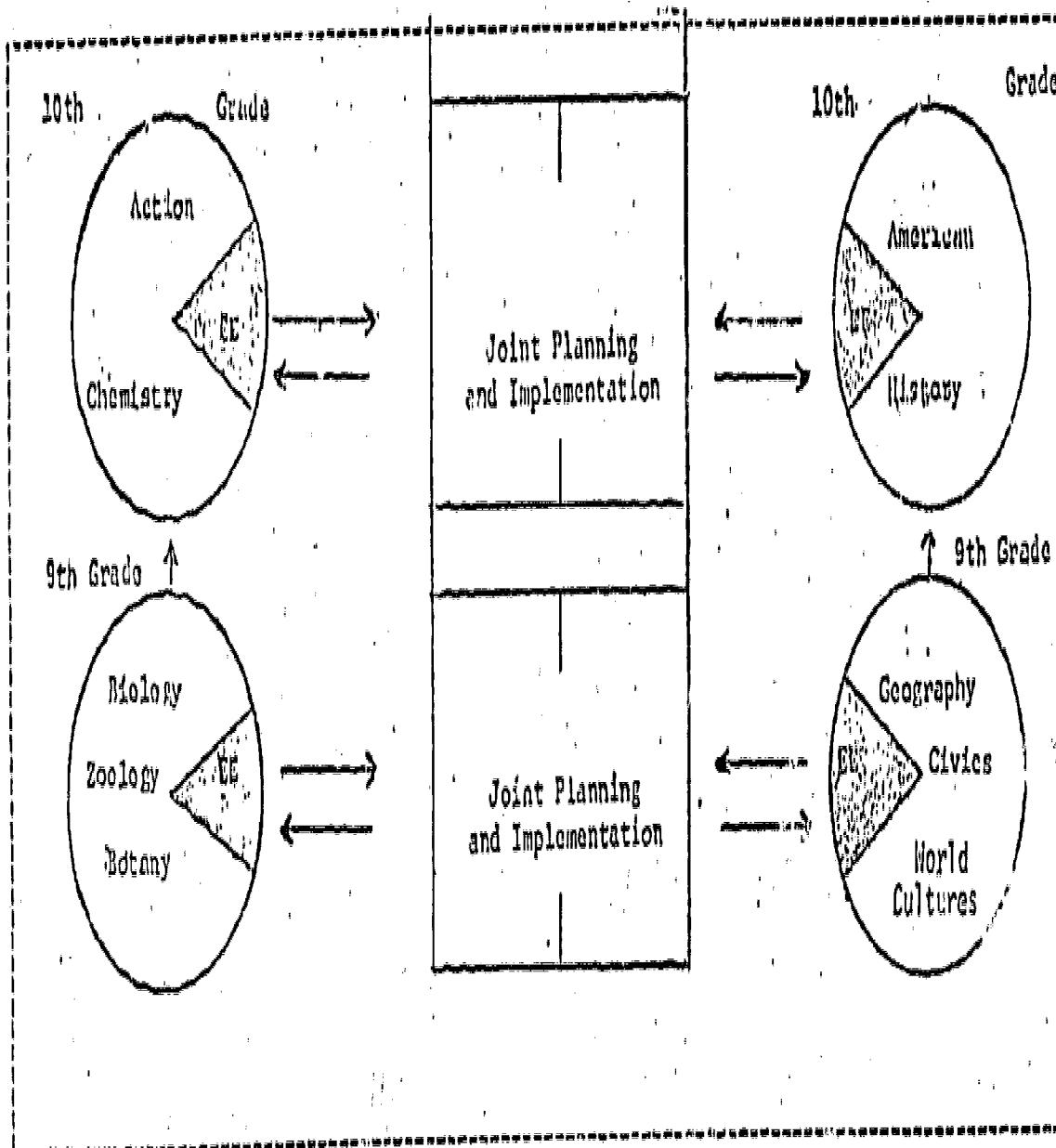
EE MODULE USED	NINTH GRADE			
	T ₁ SCIENCE ONLY	T ₂ SOCIAL STUDIES ONLY	T ₃ BOTH	T ₄ NEITHER
Class	Biology	Geography	Biology and Geography	World History
Number of Classes	1	1	1	1
Number of Students	23	26	17	27

TENTH GRADE

EE MODULE USED	SCIENCE ONLY	SOCIAL STUDIES ONLY	BOTH	NEITHER
Class	Action Chemistry	American History	American Chemistry and History	Action Chemistry
Number of Classes	2	2	1	1
Number of Students	28	36	21	21

Two general research questions were addressed: Following treatment 1) Is there a significant difference in the environmental knowledge of the four treatment groups? 2) Is there a significant difference in the environmental attitudes of the four treatment groups?

IMPLEMENTATION MODEL



INSTRUMENTS

For cognitive evaluation, a posttest and a shorter pretest, each with different items, were prepared for each grade level as the modules were being developed. These tests were based on the objectives and concepts of the modules. The posttests were more subject-specific in that they called for more detailed application of the skills and knowledge taught in the modules. Each test was interdisciplinary in that it drew from both science and social studies, and each test contained a balance of higher level and lower level cognitive items.

A Likert-type instrument was designed to measure student environmental attitudes. Items on the attitude instrument were drawn from earlier research conducted by Simpson, Rentz and Shrum (1976). Some items were modified to improve validity, and the instrument was reviewed by a qualified five-member panel. The 28-item attitude test was comprised of two subtests. Fourteen items were designed to measure attitudes related toward growth (including community population and family planning) and 14 items were designed to measure attitudes toward pollution-related factors (such as energy consumption, environmental regulation and conservation). Half of the items were written as positive statements to elicit agree-type responses. Positive items were awarded 5 points for a "strongly agree," 4 for "agree," and 3 for "undecided," 2 for "disagree," and 1 for "strongly disagree." Scoring was reversed for the negative statements.

DATA ANALYSIS

When the test data were all collected, coded and punched on computer cards, the following analyses were run:

1. Reliability coefficients of the cognitive tests and attitude tests were determined by calculating Cronbach's coefficient alpha.
2. The cognitive test data were analyzed by Analysis of Covariance (ANCOVA). (Since students were not randomly assigned to treatment groups, the pretest scores were used in covariate analysis to adjust the posttests for effects of differences in reading ability and environmental knowledge that existed preceding the treatment (Berg and Gall, 1971, p. 394). Means, standard deviations and adjusted means were calculated for cognitive scores of the four treatment groups in each grade.
3. The attitude data were analyzed by an Analysis of Covariance of the posttest scores on each of the subtests for pollution and growth attitudes using the pretest score as covariate. Means, standard deviations and adjusted means were calculated for the four treatment groups in each grade.
4. Post hoc tests were carried out on both cognitive and attitude treatment group means where a significant difference between groups was found in ANCOVA.

RESULTS

Reliability estimates for the instruments used in evaluation revealed that the attitude test was more reliable, especially in the posttests, than either of the cognitive tests. (Cognitive test reliability was probably decreased by the use of a shorter pretest, and the fact that the test had not been piloted.)

Table 2
RELIABILITY ESTIMATES (Cronbach Alpha)

COGNITIVE TEST

Ninth Grade	Pretest	.66
	Posttest	.76
Tenth Grade	Pretest	.65
	Posttest	.65

ATTITUDE TEST

Ninth Grade	Pretest	.75
	Posttest	.82
Tenth Grade	Pretest	.69
	Posttest	.76

COGNITIVE CHANGE

Analysis of Covariance of the ninth grade posttest scores using the pretest as covariate showed a significant difference (at the .001 level) among the four treatment groups. Adjusted mean scores were highest for the treatment group studying both social studies and science modules -- as might be expected. Second highest was the treatment group studying social studies only, third highest was the group studying the science module only, and the lowest adjusted mean was that of the control group.

Table 3

ANALYSIS OF COVARIANCE OF NINTH GRADE COGNITIVE POSTTEST SCORES WITH PRETEST AS COVARIATE

Source	SS	DF	MS	F
Within Cells	1871.844	88	21.271	
Covariate	496.822	1	496.822	23.357*
Treatment	1161.017		.006	18.194*

*p < .001

ANALYSIS OF COVARIANCE OF TENTH GRADE COGNITIVE POSTTEST SCORES WITH PRETEST AS COVARIATE

Source	SS	DF	MS	F
Within Cells	1787.977	101	17.703	
Covariate	613.924	1	613.924	34.680*
Treatment	181.223	3	60.708	3.412**

*p < .001

**p < .020

ANCOVA of the cognitive tests of the tenth grade slow learner classes produced an F-value significant at less than the .05 level. When posttest means were adjusted for the pretest, once again, the highest mean score was found in the group which studied both modules. However, in this grade a very close second was the group which studied the science module only. Surprisingly, the control group had the third highest mean score, and the group that studied only the social studies module had the lowest adjusted mean score.

Table 4

COGNITIVE TESTS
MEAN SCORES

NINTH GRADE		N	PRETEST		POSTTEST	
TREATMENT GROUP			MEAN (30 ITEMS)	MEAN (46 ITEMS)	S.D.	ADJUSTED POSTTEST MEAN
Science only	23	13.91	3.30	21.39	4.77	21.20
Social Studies only	26	12.58	3.99	23.27	4.99	23.86
Science and Social Studies	17	15.12	4.26	29.00	5.65	28.11
Control (No Instruction)	27	13.33	4.55	17.82	5.32	17.97

TENTH GRADE		N	PRETEST		POSTTEST	
TREATMENT GROUP			MEAN (30 ITEMS)	MEAN (46 ITEMS)	S.D.	ADJUSTED POSTTEST MEAN
Science only	28	17.21	3.99	25.47	4.62	24.55
Social Studies only	36	13.61	3.89	20.61	5.27	21.97
Science and Social Studies	21	17.00	3.96	25.81	4.63	25.02
Control (No Instruction)	21	16.29	3.65	22.43	4.60	22.09

Post hoc analysis of adjusted cognitive scores, using the Newman-Keul's multiple range test, clarified the sources of the significant difference in the treatment group means:

- 1) In the ninth grade the group which studied both modules had a significantly higher mean than all other groups. In addition, the groups which studied either the science or the social studies module were significantly different from the control group.
- 2) With the below-average tenth grade students, the group which studied both modules was significantly higher than the control group, and it was very close to the critical level which make it significantly different from the group which studied only the social studies module. The group that studied only the science module was significantly higher than the control group.

Table 5

COGNITIVE TEST

NEWMAN-KEULS' MULTIPLE RANGE TESTS ON
ADJUSTED POSTTEST MEANS FOR FOUR TREATMENT GROUPS

Ninth Grade					r	$q_{.95} r \sqrt{\frac{ms_e}{n}}$
T_4	T_1	T_2	T_3			
17.97	21.20	23.86	28.11			$(r, 85) \sqrt{\frac{ms_e}{n}}$
T_4	—	3.23*	5.89*	10.14*	4	3.60
T_1	—	—	2.66	6.91*	3	3.28
T_2	—	—	—	4.25*	2	2.73

Tenth Grade					r	$q_{.95} r \sqrt{\frac{ms_e}{n}}$
T_2	T_4	T_1	T_3			
21.97	22.09	24.55	25.03		$(r, 96) \sqrt{\frac{ms_e}{n}}$	
T_2	—	.12	2.58	3.06	4	3.10
T_4	—	—	2.46*	2.94*	3	2.83
T_1	—	—	—	.48	2	2.36

*Significant at $p < .05$

ATTITUDE CHANGE

Analysis of covariance of the posttests for the ninth grade using the pretest as covariate revealed a significant difference (at the .01 level) among the four treatment groups on the growth subtest, but not on the pollution subtest. The highest adjusted posttest mean for the pollution subtest in the ninth grade was scored by the group studying both modules, but on the growth subtest the group studying only the science module scored a little higher than the joint treatment group.

The ANCOVA of the tenth grade attitude test scores again showed no significant difference among groups for the pollution subtest.

Similar to the ninth grade results on the growth subtest there was a significant difference (at the .01 level) among the four treatment groups. Adjusted posttest means indicated that the group which studied both modules scored highest on the growth subtest and the group which studied only the science module scored highest on the pollution subtest.

Table 6

MEAN SCORES
ATTITUDE TESTS

Treatment Group	N	Total Test Scores		Pollution Subtest		Growth Subtest		Adjusted Posttest
		Pretest	Posttest	Adjusted Posttest	Pretest	Posttest	Adjusted Posttest	
Ninth Grade (N=92)								
1. Science only	23	102.34	107.44	105.16	54.34	55.83	55.09	48.00
2. Social Studies only	26	62	99.27	103.23	51.96	54.12	55.07	41.66
3. Science and Social Studies	16	100.88	107.06	105.84	53.75	57.25	56.94	47.13
4. Control	27	100.77	99.89	98.74	53.44	53.63	53.53	47.33
Tenth Grade (N=104)								
1. Science only	27	96.11	98.00	96.56	51.33	52.33	51.65	44.78
2. Social Studies only	36	91.13	90.33	92.58	48.94	48.94	49.73	42.19
3. Science and Social Studies	21	95.19	97.99	97.19	50.81	51.28	50.93	44.38
4. Control	20	95.90	96.20	94.91	56.45	50.80	50.66	45.45

Adjusted posttest scores on the growth subtest (which showed significant differences among groups) were subjected to post hoc analysis by the Duncan Multiple Range Test. These tests revealed that:

- 1) In the ninth grade average classes, students who studied both the social studies and science modules and the students who studied only the science module scored significantly higher on the attitude test than the students in the control group.
- 2) In the tenth grade below-average classes, students who studied only the science and the group which studied both modules were significantly higher than the group which studied only the social studies module, but they were not significantly different from the control group.

Table 7

ATTITUDE TESTS

DUNCAN MULTIPLE RANGE TESTS ON
ADJUSTED POSTTEST MEANS FOR GROWTH ITEMS

Ninth Grade

	T ₄	T ₂	T ₃		r	q.95r $\sqrt{\frac{ms_e}{n}}$
	45.39	47.63	49.06	50.34		
T ₄	—	2.24	3.67*	4.95*	4	3.53
T ₂	—	—	1.43	2.71	3	3.42
T ₃	—	—	—	1.28	2	3.24

Tenth Grade

	T ₂	T ₄	T ₁	T ₃	r	q.95r $\sqrt{\frac{ms_e}{n}}$
	42.57	44.38	45.10	46.37		
T ₂	—	1.81	2.53*	3.80*	4	2.44
T ₄	—	—	0.72	1.95	3	2.36
T ₁	—	—	—	1.27	2	2.24

*p < .05

DISCUSSION

On the cognitive tests and attitude tests for each grade the groups which studied the science and social studies modules produced the highest adjusted posttest means and thus showed the best performance. These results support the generalization that coordinated modular interdisciplinary environmental instruction offered in both social studies and science courses is more effective than the same type of instruction offered only in a science or social studies course. This is not too surprising since students who studied both the science and social studies module studied the subject during two class periods of the day. This "double dose" appears to have been particularly effective in promoting cognitive learning with average students.

because the ninth grade group which studied both modules scored significantly (.05) higher than the other treatment groups.

On the attitude test however, the ninth graders in the group who studied both modules scored significantly higher than the control group only.

For the average ninth grade classes the social studies and science modules appeared to be nearly equal contributors to their cognitive environmental learning, with social studies showing a little higher posttest mean than science. The science module, however, appears to exert more influence on their environmental attitude formation.

For the tenth grade students, who were below-average academically, it appeared that the science module contributed considerably more to both their knowledge and their attitudes than did the social studies module. The adjusted cognitive posttest means show that the group studying science only was but .5 lower than the group studying both modules.

When attitude test scores were broken down into subtests for attitudes toward pollution and attitudes toward growth, interesting differences from the total test results were found. The analysis of variance of pollution posttests for both grades indicate that none of three groups receiving some instructional treatment was significantly different from the control group. However, it should be noted that the pretest scores on pollution attitudes were considerably higher than those on growth. This suggests that students had previously developed positive environmental attitudes toward pollution abatement. This may be partially attributable to the effect of county newspapers which have recently published numerous stories on air and water pollution problems in the area.

The weaker influence of the social studies modules on the development of attitudes may be attributable to the multi-viewpoints analysis of local issues which the materials contained. Pro and con opinions voiced by community leaders were quoted side by side for the students to consider. Students were confronted with questions of trade-offs in regard to ecological and economic or social factors in several decision-making activities. It appears that the open-ended weighing of alternatives in social studies had less direct, positive influence on values than did the scientific experiments and discussions which emphasized ecological implications. Knowledge of the natural sciences which underscores the physical effects on the environment of man's activities probably helps to narrow value options, whereas considerations of social-political-economic alternatives may broaden value options and possibly reduce environmental commitment. Nevertheless, that is the world we live in. It is both social and physical, and if we are to promote increased knowledge (and informed decision-making along with it) and more positive attitudes toward the environment, coordinated interdisciplinary instruction in science and social studies may be the way. Obviously, more research should be conducted on the contributions and the interrelationships of these two subject areas in environmental education.

For the P.E.S Project the treatment groups which studied both the social studies and science modules at the same time were "the" experimental groups on which our main hypothesis were generated. Their overall cognitive and attitude test performance does indicate that environmental educational material, which is mainly cognitive in its instructional approach, can be integrated into regular courses in science and social studies to generate both increased knowledge and positive attitude changes.

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ENVIRONMENTAL EDUCATION AND THE INTERRELATIONSHIPS AMONG ATTITUDE, KNOWLEDGE, ACHIEVEMENT, AND PIAGETIAN LEVELS

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INTRODUCTION

In 1971 the Ames Community School System, Ames, Iowa received an ESEA Title III grant for the development and implementation of a K-9 environmental education program entitled, "Environmental Curriculum Opportunity" (ECO). The purpose of Project ECO was to broaden and enrich the base of activities concerning the understanding and wise use of the environment. (A detailed description of Project ECO was reported by Kiser and Frazier, 1977.)

The purpose of this study was to evaluate Project ECO after several years of experience. This was accomplished by assessing students' growth in knowledge and attitude across grades 4-6, 7-9, and 10-12 and by comparing the knowledge and attitude scores of Project ECO students with those of students in a nearby school system which had similar socioeconomic levels and curricula but which lacked a K-9 environmental education program. Related objectives were: 1) to assess the effects of gender on knowledge and attitude; 2) to determine the relationships among knowledge, attitude, standard achievement scores and Piagetian levels; and 3) to investigate the idea that mental transfer from outdoor to indoor activities increases sharply at about age 13 years.

The dependent variables in the study were knowledge of the environment, and attitude toward the environment. The independent variables were standard achievement scores, Piagetian levels and gender. Multiple analysis of variance, correlation techniques and t-test analysis for matched pairs were used to analyze the data.

RESEARCH DESIGN AND PROCEDURES

Subjects

The subjects for this study consisted of a stratified random sample, by gender and grade, of 3,408 students from grades 4 through 12 in two school systems. The average sample size was 100 males and 100 females at each grade level from grades 4-9, and about 75 males and 75 females at each grade level from grades 10-12.

Instrumentation for Data Collection

A test of knowledge of the environment and a test of attitude toward the environment were developed for each of the levels studied: elementary (4-6), junior high (7-9), and high school (10-12). The tests of knowledge and attitude at the elementary and junior high levels were developed by the Project ECO coordinator and staff, and consisted of items that were specific to the curriculum of Project ECO. KR-20 coefficients of reliability were 0.66 for the attitude test and 0.58 for the knowledge test at the elementary level, and 0.79 for the attitude test and 0.69 for the knowledge test at the junior high level. At the high school level, items for the knowledge and attitude tests were taken from Hulleman (1972), who had selected them from a study by Roth and colleagues (1970). The items were not specific to Project ECO but were more general and global in nature. KR-20 coefficients of reliability were 0.79 for the attitude test and 0.78 for the knowledge test at the high school level.

A battery of six Piagetian tasks were administered to 358 students in grades 4-12 in the school system with the ECO program. The six tasks were conservation of area, weight, and volume (clay and cylinders), separation and control of variables as described by Lawson, Norland and Kahle (1975), and combinatorial reasoning as described by DeLuca (1977). A possible total Piagetian battery score of 18 was based on the summation of the six tasks.

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Stanford Achievement test scores were available for grades 4-8 in the Project ECO school system, but not in the comparison school system. Scores from the Iowa Test for Educational Development were available for grades 9-12 in both school systems.

DATA ANALYSIS AND RESULTS

Data analysis and results are reported in three sections based on grade levels: grades 4-6, grades 7-9, and grades 10-12. The relationships between grade levels are discussed subsequently.

Grades 4, 5, and 6

The data for the ECO school system indicated continuous growth in knowledge and attitude for both males and females across grades 4, 5, and 6. Analysis of variance of the knowledge and attitude scores indicated that the amount of growth was significant (0.0001 and 0.001). The data also indicated that males scored significantly (0.001) higher than females on the knowledge test. The gender effect on attitude was not significant (0.05).

Correlations between knowledge, attitude, Stanford Achievement scores and Piagetian scores for students in Project ECO are shown in Table I. The data indicate that

TABLE I
Correlations for Grades 4, 5, and 6 in the Project ECO Program

Grade	Social						Total			Total			Total		
	Knowledge	Science*	Science*	Math*	Total	Battery*									
4	5	6	4	5	6	4	5	6	4	5	6	4	5	6	4
Attitude	.29	.36	.55	.28	.38	.35	.31	.33	.37	.25	NS	.34	.29	.36	.38
Knowledge				.47	.50	.54	.50	.47	.54	.42	NS	.43	.50	.46	.53
Social													NS	NS	.44
Science							.82	.83	.85	.75	.39	.71	.88	.87	.88
Science								.73	.37	.75			.88	.89	.90
Total													NS	.34	.41
Math													.87	.43	.86
Total													NS	.32	.40
Battery														NS	.34
															.39

Number of students for Piagetian correlations range from 41 to 47. $p < 0.05$

Number of students for all other correlations ranged from 198 to 202. $p < 0.0001$

*Scores from the Stanford Achievement Test.

The correlations between knowledge and attitude increase as grade increases. The correlation between knowledge and attitude for combined grades 4, 5, and 6 is 0.42 (df=592, $p < 0.0001$). No other variable correlated as high with attitude. Knowledge correlated rather consistently at about 0.50 with all other variables except total math and total Piagetian scores.

The data for the comparison school system indicated significant (0.001) growth in knowledge and attitude across grades 4, 5, and 6, without significant differences between male and female students. Correlation between knowledge and attitude was 0.39 (df=592, $p < 0.0001$). Although a multiple analysis of variance of data between school systems indicated significant (0.0001) differences in favor of the Project ECO system, no baseline data were available to assess and control for initial differences that may have existed between the two populations.

Grades 7, 8, and

Analysis of variance of the knowledge and attitude scores for the ECO school system indicated significant (0.0001 and 0.01, respectively) growth across grades 7, 8 and 9 and a significant (0.001) gender effect on knowledge in favor of the male students. No significant gender effects were found on attitude scores.

Correlations between knowledge, attitude, standard test scores and Piagetian scores for students in the ECO program are shown in Table II. The data indicate that the

TABLE II
Correlations for Grades 7, 8, and 9 in the Project ECO Program

Grade	Knowledge			Math			Science*			Total Read*			Composite*			Total Piaget		
	7	8	9	7	8	9	7	8	9	7	8	9	7	8	9	7	8	9
Attitude	.27	.45	.44	.33	.43	.37	.40	.44	.36	.36	.45	.40	.42	.51	.42	NS	NS	.41
Knowledge				.45	.49	.48	.52	.60	.50	.50	.52	.45	.52	.56	.52	.41	.37	.39
Total																		
Math							.79	.78	.70	.68	.65	.71	.89	.89	.80	.31	.38	.62
Science										.75	.74	.88	.89	.91	.89	NS	.31	.64
Total																		
Read													.85	.82	.94	NS	NS	.62
Composite																NS	NS	.64

Number of students for Piagetian correlations range from 35 to 40. $p < 0.05$

Number of students for all other correlations range from 128 to 170. $p < 0.001$

*Grade 7 and 8 scores from Stanford Achievement Test; grade 9 scores from Iowa Test of Educational Development.

correlations between knowledge and attitude increase from grade 7 to grade 8, and then decrease slightly at grade 9. The same trend is true for correlations of the standard test scores with knowledge and attitude.

Analysis of variance of the data for the comparison school indicated significant (0.0001) growth in knowledge and attitude across grades 7, 8, and 9, and significant (0.001) gender effects in favor of males on knowledge, and in favor of females on attitude. Analysis of variance of the data between school systems indicated significant differences in favor of the ECO system on knowledge (0.0001) and attitude (0.05).

The availability of the same standard test scores at grade 9 made it possible to control for differences in academic ability between the two school systems. Ninth grade students from both school systems were matched on their composite scores of the ITED and compared on their scores on knowledge and attitude. The t -values for comparison between grade 9 at the two school systems indicated a significant (0.0001) difference in favor of the ECO system on knowledge and no significant (0.05) differences on attitude.

Grades 10, 11, and 12

The results of analysis of variance of the knowledge and attitude scores indicated significant (0.02) growth on both measures across grades 10, 11 and 12, and significant (0.0001) gender effects in favor of females on both knowledge and attitude.

Correlations between knowledge, attitude, standard test scores and Piagetian scores for grades 10, 11, and 12 are shown in Table III. The data indicate moderately strong correlations (0.74 to 0.79) between knowledge and attitude.

TABLE III
Correlations for Grades 10, 11, and 12 in the Project ECO School System

Grade	Knowledge			Total Math*			Science*			Total Read*			Composite*			Total Piaget		
	10	11	12	10	11	12	10	11	12	10	11	12	10	11	12	10	11	12
Attitude	.79	.74	.75	.38	.25	.40	.54	.30	.44	.61	.43	.44	.60	.46	.47	NS	NS	NS
Knowledge				.37	.27	.37	.52	.41	.44	.62	.43	.44	.58	.45	.45	NS	NS	NS
Total							.69	.72	.69	.66	.69	.69	.81	.82	.83	NS	.52	.37
Math										.85	.88	.90	.89	.87	.88	NS	.49	NS
Science																		
Total																.95	.93	.94
Read																NS	NS	NS
Composite																NS	.40	NS

Number of students for Piagetian correlations range from 32 to 39 per grade $p < 0.05$

Number of students for all other correlations range from 129 to 170 per grade $p < 0.001$

*Standard scores from Iowa Test of Educational Development.

Analysis of variance of knowledge and attitude scores of the comparison school system indicated no significant growth on either measure across grades 10, 11, and 12. No significant gender effect or interactions were detected. Analysis of variance of the data between school systems produced significant (0.0001) effects in favor of the ECO school system on knowledge and attitude. In order to compare the two schools while controlling for academic ability, students at grades 10, 11, and 12 in both school systems were matched on the composite scores on the ITED and compared on knowledge and attitude scores. The results of the comparison indicated no significant differences between school systems.

FINDINGS, DISCUSSION AND CONCLUSIONS

Project ECO Evaluation

The finding of significant growth in knowledge and attitude scores across grades 4-6 and 7-9 in the K-9 ECO school system was as expected. If significant growth had not occurred, the effectiveness of the ECO program would have been in question. It was interesting to note that significant growth in knowledge and attitude extended beyond the K-9 ECO program and continued across grades 10-12. Although these findings were supportive of Project ECO, such findings per se did not confirm the effectiveness of the program because there were other curriculum factors that contributed to the growth. Moreover, the comparison school system also showed significant growth in knowledge and attitude scores across grades 4-6 and 7-9, but not across grades 10-12.

Analysis of variance of knowledge and attitude scores between the two school systems indicated significant differences in favor of the ECO school system across all grades. But this finding, although interesting, should be viewed loosely because analysis of variance could not adjust for initial differences in academic abilities between the two school systems. At the ninth grade, however, control for academic ability by matching students on composite scores of the ITED, and comparison on knowledge and attitude scores, indicated significant differences in knowledge in

favor of the ECO school system and no significant differences in attitude. This finding at the end of the K-9 Project ECO provided strong support for Project ECO in terms of its effectiveness in promoting knowledge of the environment.

The lack of significant differences in attitude at grade nine between the two school systems indicated that Project ECO was more effective in promoting knowledge than in promoting attitude. This finding appeared to result from the fact that the ECO program emphasizes knowledge of the environment. The contrast in correlations between knowledge and attitude at grades 4-9 and 10-12 suggested that there was a need for more attention to attitude at the lower grades than at the upper grades. It seems reasonable, however, to assume that attention to both knowledge and attitude would be beneficial at all grade levels (Tanner, 1974).

The Effects of Gender

The effects of gender on attitude scores indicated that females scored higher than males at all grade levels and significantly higher at grades 7-9 and 10-12. On the tests of knowledge the effects of gender were equivocal at grades 4-6, significantly in favor of males at grades 7-9, and consistently in favor of females at grades 10-12. These findings suggest a need for more concern and research concerning the effects of gender on knowledge and attitude scores.

Relation of Scores to School Curricula

It was interesting to note that plots of the means for knowledge and attitude scores for the three grades at each of the three levels (elementary, junior high and senior high) in the ECO school system tended to parallel similar plots for the comparison school system. This phenomenon was believed to have resulted from the similarities of the curricula in the two school systems. For example, both school systems teach life science at the seventh grade, physical science at the eighth grade and earth science at the ninth grade. Figure 1 shows the curves for

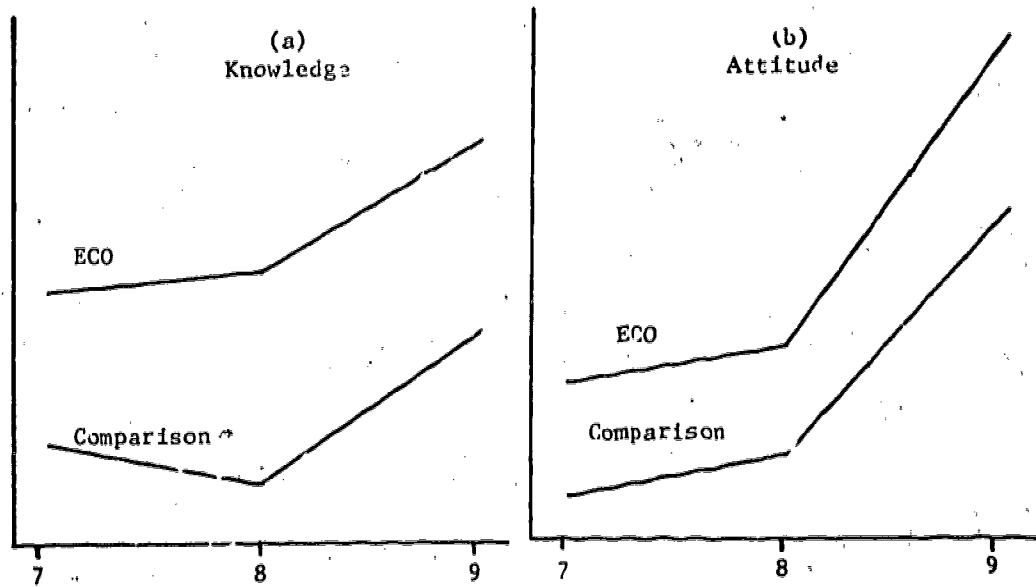


Figure 1. Plots of a) mean knowledge scores, and b) mean attitude scores for the ECO school system and the comparison school system across grades 7, 8, and 9.

the means of the knowledge and attitude scores for both school systems. The attitude curves are strikingly similar. The knowledge curves indicate a decrease in knowledge scores from grade seven to eight for the comparison school system and a slight increase for the ECO school system. Both school systems show increases in

knowledge between grades eight and nine. It appears that physical science had a retarding effect on both knowledge and attitude at the eighth grade, relative to life science at the seventh grade and earth science at the ninth grade. Students in the K-9 ECO school system had uniformly scheduled outdoor ECO activities at grades 7 and 9, and only sporadic activities at grade eight. This could help to explain why the ECO knowledge scores did not decrease at grade eight, and why the ECO knowledge scores were significantly higher than those of the comparison school system when compared under matched conditions. This also helps to point out that outdoor environmental programs in general are inherently linked to classroom curricula and one should expect that paper and pencil tests of outdoor activities and concepts will be influenced highly by classroom instruction.

The Correlation of Knowledge and Attitude Scores

The correlations between knowledge and attitude, and attitude and standard test scores provide support for the existence of a significant relationship between knowledge and attitude. Although the use of different knowledge and attitude tests at the elementary, junior high, and high school levels require caution in extrapolating across grade levels, the trend of increased correlations with increased grade levels appear to be much more than mere coincidence. If one accepts the trend as more than an artifact of the tests used, how can the trend be explained?

One possible line of reasoning is as follows. Young students are inconsistent in applying their newly found knowledge so that correlations between knowledge and attitude (or between knowledge in different subjects) tend to be low. As students mature intellectually, they become more consistent in their thinking and application of their knowledge. Thus correlations between different types of knowledge as well as between knowledge of environment and attitude toward the environment increases. This explanation is predicated on the assumption that the population of students is not adversely biased by their home or community life. For example, if students come from a community which is highly dependent on mining or forestry for its' livelihood, then it is doubtful that knowledge of the environment will influence attitude toward the negative aspects of mining or deforestation. Such a situation could very well lead to a low correlation between knowledge and attitude. It is conceivable that bias may be a significant factor in reducing correlation between knowledge and attitude. The greater the bias (or potential for loss of livelihood) the lower the correlation. This hypothesis is certainly worthy of future testing.

Correlation With Piagetian Scores

According to Piaget's (Inhelder and Piaget, 1958) theory of intellectual development, students are not able to handle abstract concepts before age 12 years old, on an average. Lovell (1951) reports that the majority of students can not transfer thinking from one learning situation to another before age 13 years old. These findings suggest that a somewhat sharp rise in test scores should occur at the seventh or eighth grade level, with increased correlations between Piagetian scores and knowledge and attitude. The data in this study indicated a sharp rise in knowledge and attitude scores occur at the ninth grade level, and although moderately strong correlations were found between Piagetian and standard test scores, the expected high correlations between Piagetian scores and knowledge and attitude were not found. The question of increase in ability to transfer thinking from outdoors to the classroom and vice versa at about age 13 years old has neither been confirmed nor rejected by this study.

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CONTEMPORARY AMERICAN ISSUES: A 9TH GRADE SOCIAL STUDIES COURSE THAT INCLUDES AN URBAN FIELD EXPERIENCE

Karen S. Hollweg¹

"Issues" or "problems" courses are offered in many secondary schools. Typically they are taught (1) as survey courses, reviewing the variety of issues that face our nation, or (2) as courses in inductive analysis in which students are presented with an abundance of primary source material representing opposing sides of issues and are then asked to analyze the information and propose the best solutions, or (3) as a combination of these.

In 1976, Jefferson County Schools began a revision of its Contemporary American Issues curriculum. I became involved in this revision hoping that the course could be more than just a survey course or a class emphasizing analysis of presented material.

Citizens are rarely, if ever, presented with pros and cons of an issue neatly spelled out for them. They have to rely on information presented by the media, printed reports from government agencies, businesses, or special interest groups, and their own sleuthing to get beneath the surface and begin to understand the different sides of an issue.

My hopes were that Contemporary American Issues could be redesigned to expand the students' experiences beyond their suburban school environment and to arm them with the social skills and cognitive abilities necessary to find out about and deal intelligently with current issues. Now, after two years of work, we have gone through several drafts, identified resource materials, piloted our ideas in classrooms, and finally produced a curriculum guide² which is currently in use in 13 schools. I would like to share the result of the revision with you.

COURSE GOALS

Contemporary American Issues, a 9-week social studies course for ninth graders, began with two main goals: (1) to increase students' awareness of current issues, and (2) to enable students to develop investigative and analytical skills by finding out about and taking stands on issues of interest to them in the Denver metropolitan area. From the outset, we assumed that these goals could best be achieved by providing students with experiences that would require them actively to explore and investigate issues in the Denver metropolitan area.

In general, the students of suburban Jefferson County (and, I believe, the population in general) perceive Denver as the city "over there." In addition, many feel that most, if not all, "evils" exist in or emanate from Denver (e.g., crime, poverty, air pollution). The fact that we, as suburbanites, depend on the urban center for goods, services, recreation, and the like and that we are part of the metropolitan area (both its positive aspects and its problems) is not perceived by many. Because of this situation, we decided a third goal was necessary if we were to achieve the first two. The course would have to (3) acquaint students with the urban environment, if they were to be able to identify issues of a metropolitan nature and draw on resources throughout the metro area in their investigations.

Although each teacher adapts the course slightly to fit his/her particular classes, all of the classes contain common elements. The following description of the course is a composite, drawing from the experiences of teachers throughout the district.

WHAT ARE SOME CURRENT ISSUES?

This question is the focus of the first two weeks of the course. Students find the answer by reading newspapers and periodicals, listening to the news, interviewing their parents and neighbors, doing telephone surveys and participating in an Urban Exploration.

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² The curriculum guide Contemporary American Issues, Jefferson County Schools, Lakewood, Colorado, has been submitted to ERIC/SMEAC, Ohio State University, and will be available through the ERIC system.

The Urban Exploration is a 4- to 5-hour field experience in which small groups of 4-5 ninth graders, accompanied by trained Senior Leaders, travel to downtown Denver using public transportation, experience the city on a work day, contact many different people there, and from their observations and conversations learn about many current issues. This activity, based on a list of scavenger-hunt-like items, requires students to observe and talk to people involved in day-to-day life in the city, recreational activities, and the city's businesses. Each group must also complete one item that requires extended observations and/or an indepth interview. Sample items are listed in Appendix 1. The curriculum guide contains over 75 items, and teachers and students are continually adding new ones.

With up to three or four classes going downtown on one day, logistics and advance planning are most important. To avoid over-loading any one office, individual, or area of the city with student inquiries, one of two strategies is used. Either small groups choose and sign up for different items (so that no two groups are doing the same item) or each small group's movement is restricted to a designated section of the downtown area (so that no two groups are covering the same ground).

Parent permission slips, class release forms, and communication with the administration and faculty are a must, as with any field trip arrangements. Senior Leaders must be recruited from neighboring senior highs and trained. (District-approved procedures and suggestions for handling all these details are provided in the curriculum guide.)

By the time students have completed an Urban Exploration, they have begun to acquire and develop skills for getting around downtown, asking questions and interviewing adults outside of school, and finding out about current issues (Appendix 2). Each group will have become familiar with only one segment of the urban environment, but follow-up class discussions present each class with a kaleidoscopic view of the many different aspects of the city that students experienced, and enable the students to perceive more vividly a variety of issues.

HOW DO WE INVESTIGATE AND EVALUATE ISSUES?

In the third week, the class begins an in-depth investigation and evaluation of one current issue. Ideally, the issue is chosen collectively by the students and teacher based on their previous experiences and discussions. Issues chosen in this way will obviously reflect subjects in which the students are most interested and find worthy of their efforts and topics that are in the fore-front of public opinion (e.g., the drought of 1977; how we will be affected and what we can do about it; or air quality: what are the causes of pollution, how bad is it really, and what can be done about it?).

It is also possible for the teacher to choose unilaterally an issue for class investigation. This alternative is usually taken by the teacher who does not feel comfortable with investigating current issues due to lack of classroom experience with this approach and/or lack of familiarity with community resources. To aid such a teacher, the curriculum guide contains background information, suggested teaching strategies, and lists of possible resources for land use and old age issues. Class investigations of these issues are most successful if the teacher, in introducing the issue, relates it to specifics that the students have uncovered in their initial activities and explorations (e.g., the increasing number of housing developments which are using up the open land in the foothills, the difference between the high-rise buildings downtown and the single-level structures in the suburbs, the senior citizens whom students met in the city, the new old-age home adjacent to the school).

Regardless of the issue chosen, the class investigation involves identifying specific questions that need to be answered, collecting as much information as possible about the issue, and finding out the opinions of different factions and the reasons for differences in viewpoints. Small groups of students are formed to investigate different aspects of the issue. Class time is spent planning and organizing, drafting surveys and interview protocols, and identifying sources of information. Periodically the small groups share their findings with each other, and the class discusses its progress.

Primary student reference books are the telephone book and Investigating Your Environment (Addison-Wesley). This book, the closest thing to a textbook for the course, contains suggestions for planning investigations, surveying, doing interviews, and collecting some kinds of technical data, such as air and water quality measurements, noise level, population and land use statistics. Students may use any section of the book that is useful to them.

"Homework" consists of doing small group work that cannot be done during class time and may include making phone calls, collecting data, or visiting governmental agencies.

The teacher serves as an ad hoc member of each small group. He/she asks questions, makes suggestions (which the group may or may not choose to follow), and monitors the progress of each group. In addition to helping resolve problems that may arise, the teacher's most critical role is to make sure that the information collected is appropriate and will answer the questions the class has posed, that all viewpoints of the issue are being sought and considered, and that the small groups have opportunities to share their findings so that the class doesn't lose sight of the whole issue.

When the class investigation is complete, the students are responsible for identifying and presenting their findings to an interested audience. This may be the general public (via a newspaper article or letter to the editor), the student body (via the school paper), or a specific group within the community. Recently, three classes that chose to investigate the recommendations of a school district task force concerning redistricting to alleviate school overcrowding in areas of rapid growth collectively presented their findings to the school board at its monthly meeting.

In the end, each student has access to everything learned during the investigation by all the other class members. Despite this common base of information, different students reach different conclusions because they weight the findings and sift the information through different sets of values. Generally a culminating class discussion is followed by an activity requiring each student to state his/her own stand on the issues investigated and his/her reasons for taking that stand.

INDIVIDUAL INVESTIGATIONS

The final 3-4 weeks of the course are spent with class members investigating a variety of issues. Working as individuals or in small groups, students choose issues of special interest and import to them. Using the skills learned from the class investigation, they each plan and carry out an investigation, communicate their findings, and take a stand on their chosen issue. The topics chosen by students for their individual investigations (Appendix 3) indicate the variety of issues in the physical and social environment that may be investigated in any one class.

OUTCOMES OF THE COURSE

The outcomes of this course are best summarized by student feedback from the pilot classes. When asked what the most important things were that they had learned, students wrote:

"...that there is a lot more going on in our community than I thought."

"...how to get in touch with people to find out information."

"...that downtown is not a slum area."

"...how to work with people and find where to find answers."

"I learned that anybody can investigate and learn something about an issue."

Such feedback and the quality of students' investigations indicate to us that Contemporary American Issues does indeed achieve the goals it is intended to.

Another measure used in judging courses of this kind is community feedback. Principals and teachers have received phone calls and comments from parents and community members which have been complimentary of the manner in which the students have conducted themselves and which have commended the teachers for educational experiences they have provided students.

Contemporary American Issues enables pupils to develop skills that will be useful to them in learning about and evaluating issues throughout their lives. Both students and teachers find this an exciting way to learn.

ACKNOWLEDGEMENTS

The following teachers made major contributions to the development and implementation of Contemporary American Issues: Doug Thompson, Bill Braun, Faith Gunther, Steve Roberts.

APPENDIX 1. SAMPLE ITEMS FOR THE URBAN EXPLORATION

1. Find a songbird singing and bring back proof that you did.
2. Go to the oldest church that's still in use and prove you were there.
3. Bring back a container that held food served by a restaurant that has meals costing \$14 and more.
4. Find an apartment for rent and find out how much it costs.
5. Bring back a used Greyhound bus ticket.
6. Find some senior citizens playing checkers, chess, shuffleboard or engaging in a similar pastime and bring back something to prove it.
7. Find an example of extreme poverty. Bring back something representative of it or proof of it.
8. Find out how many trains arrive in Denver each day and what they bring.

9. Look out of a window at the top of one of the tallest buildings and bring back proof that you did it.
10. Bring back a tentacle of a squid or octopus.
11. Bring back a strip of ticker tape.
12. Find a factory and bring back a product sample.
13. Pick an office building, describe it, and find out what kinds of businesses occupy most of the offices in the building.
14. Find out what conventions are in town.
15. You haven't eaten for three days and you have no money. Find a place to eat legally. Describe the food that was served.
16. You are a bank president. You would like to live downtown, within a mile or two of your bank. You can spend about \$1,000 to \$1,500/month on housing. Describe the place you would choose to live.
17. Find a small business (NOT a chain store or restaurant) that appears to have quite a few customers. Interview the owner or manager to find out what the advantages and disadvantages of a downtown location are. (You may need to make an appointment to return at a more convenient time.)
18. Interview 3 people who work in Denver and live in Denver. What do they see as the advantages and disadvantages of working and living in the city?
19. Interview 3 people who commute into Denver. Find out how they commute and what they like and dislike about it. Have they considered moving closer to work?
20. Find out what the Denver Urban Redevelopment Authority is and what projects are currently under construction. Interview the people living in the construction area to learn how they feel about it.
21. Interview a Denver Policeman. Find out how he feels about working in the inner city.
22. Visit the office of a government official. Find out what he/she believes is the most important contemporary issue.
23. Talk to a cab driver and find out his views of downtown traffic conditions.
24. Talk to a priest or minister of a nearby church to find out what he believes is the number one environmental issue.

RESPONSES OF STUDENTS TO URBAN EXPLORATION
IN THREE PILOT CLASSES

	for the first time	PERCENT got experience so that I can do it better now
I went downtown	13	85
I rode on RTD buses	40	55
I used a map to find my way around Denver	52	38
I talked to a politician or public figure	50	17
I talked to an important person downtown	50	17
I talked to an average person who lives in Denver	28	45
I talked to an average person who works in Denver	47	48
I went into a government office or building	37	40
I went into the office of a big business or bank	38	52
I went into a church or religious building downtown	18	18
I went into a place that takes care of needy people	18	10

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TOPICS CHOSEN BY STUDENTS FOR INDIVIDUAL INVESTIGATIONS

TOPIC	Major Sources of Information:	Findings Communicated to:
How common is child abuse and what is being done to prevent it?	Doctors, nurses, a judge, social workers, a local TV reporter who had done a special on child abuse.	Child Care class.
Is the water quality in Clear Creek good enough to support fish?	Measurements of pollutant levels in water, county health department.	Local chapter of Trout Unlimited.
Will the Denver airport be able to handle the traffic projected for the year 2000?	Denver newspaper, airport planning office, Colorado Department of Transportation.	Contemporary American Issues class.
How do bums survive downtown and what is being done about them?	The bums, soup kitchens, social service agencies, city planning department, businesses in the skid-row area.	Contemporary American Issues class.
What is being done about teenage alcoholism in this area?	Alanon, Alateen, school counselors, Colorado Department of Motor Vehicles.	School Newspaper.
Will the noise ordinance restricting motorcycle use reduce noise?	Measurements of noise levels from various sources, motorcycle dealers, neighboring city government with a noise ordinance.	City Council.
Are there plans for more teenage recreational facilities in this area?	City planning department, existing owners of recreational facilities, teenagers.	City Planning Department.
Is divorce a major cause of people moving so often?	Real estate offices, moving companies, social service workers, neighborhood surveys.	A family living class.
Is there a difference between "organic" foods and "super market" foods?	Health food store and super market managers, nutritionists.	Letter to the editor of local paper.

THE ENVIRONMENT ISSUES TEST (EIT): A NEW ASSESSMENT INSTRUMENT FOR ENVIRONMENTAL EDUCATION

Louis A. Iozzi¹

INTRODUCTION AND RATIONALE

Environmental Crisis--A Values Crisis

Not too long ago we celebrated the 200th birthday of our nation. These past two centuries can be characterized as a period of phenomenal growth--a period probably unmatched by any civilization in the history of humankind. Our 200 years of progress, however, were not accomplished without expense. The old maxim that "you get nothing for nothing" or as Barry Commoner has labeled as his "fourth law of ecology"--"There's no such thing as a free lunch"--was never more appropriate (Commoner, 1972). Simply, in the process of achieving a phenomenal rate of growth we placed excessive demands on nearly all of our environmental support systems.

After more than 200 years we are finally beginning to realize that responsible environmental decision-making is no simple matter. If decisions related to environmental quality were solely questions of a scientific/technological nature, the task of deciding what is "right" might perhaps be easier. One could, as an example, use cost/benefit analysis and make a relatively objective decision based on the factual data at hand. It is my opinion, however, that any environment-related decision based totally on scientific/technological considerations, while ignoring social concerns and societal values, is extremely shortsighted, naive, and destined for failure. No plan for environmental action can be implemented effectively without the sacrifices and full cooperation of society. On the other hand, no intelligent free society will--or should for that matter--cooperate blindly and without an understanding of why they are being asked to make those sacrifices. Environmental quality is, in my opinion, at least as much a social issue as it is a scientific/technological issue. Accordingly, environmental decision making at all levels must include what Harvey Brooks has referred to as the "fragile," "humane," "intangible," or "soft" values (Tribe *et al.*, 1976).

That the so-called "environmental crisis" is a values crisis can hardly be disputed. This is not to say that Americans do not value their surroundings and the resources which they contain. A survey conducted in 1975 by Opinion Research Corporation in Princeton, New Jersey, found that even during a time of recession, high unemployment and rising fuel costs, a majority of the public did not want to see reductions in environmental standards in order to solve our economic and energy problems. Americans' concern about a quality environment persists it seems--but so do, unfortunately, the powerful consumption drives that antedate it; the consumption drives which even a recession have not dampened. These values--our cherished life style which, for the most part, is based on a growth concept and our desire to do something about our deteriorating life support systems--are in conflict.

The Nature of our Environmental Values Crisis

Clearly, different values have dominated society at different times in history. During the earliest period a personal survival ethic was dominant. At another time in the history of our nation a work ethic prevailed. At present a growth ethic dominates. In my opinion and that of many others in the field of environmental education, it is time for a new ethic to prevail--an environmental ethic.

The development of an environmentally ethical citizenry is a qualitatively significant step beyond environmental literacy--a major goal prior to this time. I believe that one who is environmentally ethical is at least as knowledgeable as the environmentally literate person but in addition exhibits a reverence and respect for all environments--natural and manmade. In addition, the environmentally ethical person, I believe, is motivated to change his or her life style to ensure the survival of a quality environment for all living things.

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Environmental quality and responsible decision-making are values issues of a particular kind, however. The term "values" can, depending on whose definition you agree with, span a broad spectrum of objects, ideas, concepts and so on, that people cherish. I submit that when confronted with values decisions regarding food production, and consumption, population stabilization, nuclear power, energy production and consumption, utilization and depletion of natural resources of all kinds, pollution, and indeed nearly all environment-related decisions, we are in fact dealing with moral values.

Education and Environmental Values

How do we approach environment-related ethical value considerations in education? If we approach values as absolutes as in "character education," or "socialization education," do we teach that nuclear energy is too dangerous and that nuclear power must not be used under any circumstances or, do we teach that DDT is too harmful and therefore must be banned not only in America but throughout the world? Do we teach that decisions are relative to an individual's value system, every value having equal merit so that one cannot make judgments of another's action? If this "values free" clarification approach becomes the student's future decision-making mode, does he or she condone a policy that states "everyone is free to use--or abuse--the environment in his or her own way?"

The cognitive developmental approach of Lawrence Kohlberg, I believe, provides the basic framework for developing a highly effective education model for preparing students to deal both with our urgent environmental concerns and to instill an environmental ethic, which should result in more effective and environmentally sound decision making. The basic idea of Kohlberg's theory is that people--as they mature physically and cognitively--also mature in their ability to make moral judgments. That is, from infancy the child develops from a totally egocentric orientation to more mature stages in adolescence and potentially principled levels in adulthood. At the principled stages reasoning is based on a primary concern for universal justice and equity for all. Although cognitively capable, development in much of society is arrested and limited to reasoning based on respect for authority and conforming to or following social rules and order.

Resolving Environmental Conflict

Not only, in my opinion, are environmental issues moral/ethical issues, but in addition, I suggest that the bulk of our environmental problems stem from the fact that we have been making environment-related decisions and exhibiting behaviors typical of Kohlberg's lower, self-serving/self-interest stages at the expense of our surroundings and our resources.

The basic idea and a fundamental goal of education programs based on Kohlberg's theory is growth and upward progressive development of cognitive structures through an individual's learning experiences and interaction with his or her environment. For environmental education, this means that if we can provide experiences to help students advance through the stages more quickly and to their highest potential, then I maintain that: environmental conflicts can be resolved more equitably; that decision makers at all levels will make more environmentally sound decisions; that since reasoning level is related to actual behavior, society will begin to behave in a more environmentally responsible manner.

My colleague, Janey Cheu, presented a paper earlier which described a curriculum model based in part on Kohlberg's theory which we developed and are presently using in a curriculum development project at Rutgers University. (That paper is also included in this volume, - Editor).

If, as I contend, Kohlberg's basic philosophy and methodology are appropriate for environmental education, where do we begin? How can we determine the maturity level of our students--for that matter anyone--when it comes to moral/ethical reasoning related to environmental decision-making? How can we determine how successful our efforts and programs are to promote more environmentally and ethically sound decisions?

THE ENVIRONMENTAL ISSUES TEST

As a part of a major study conducted in 1975 and 1976 (Iozzi, 1976), I developed an instrument called the Environmental Issues Test. The Environmental Issues Test, or EIT, is based on a similar instrument developed by James Rest and his colleagues at the University of Minnesota. While Rest's Defining Issues Test was developed to determine moral/ethical reasoning development related to general social issues, the Environmental Issues Test was designed to determine a similar kind of development but in an environmental context.

The EIT consists of five moral dilemma stories dealing with the environment and the respondents decide what the central character or characters should do in each of the stories; a condensed version of one dilemma is attached. In addition, for each of the stories, the respondent is requested to evaluate a set of 12 issues by indicating how important each issue is in deciding what the main character or characters should do. That is, the respondent rates each of the 12 issues as being "of great importance," "of much importance," "some importance," "little importance," or "of no importance." For example, in one dilemma story based on the Four Corners Energy Complex in the Southwest, a group of American Indians is faced with a decision about whether they should sabotage a power station for the sake of environmental quality. In this dilemma, the respondent must:

1. Decide whether the power station should be sabotaged by responding either "yes", "can't decide," or "no."
2. Indicate how important each of 12 issues is in making that decision.

For example:

- a. Whether laws are going to be upheld.
- b. Are the Indians willing to risk getting shot or going to jail for the chance that blowing up the power station might help?
- c. Whether the power company's rights ownership must be respected?

...and so on through 12 issue statements.

3. Rank the 4 most important issue statements in priority order.

For example: issue statement 3 might be most important; issue 8 second most important; issue 12 third, and issue 4 least important.

Each of the issue statements for each moral dilemma was developed to exemplify some distinctive characteristic of a Kohlberg stage and are keyed to stages 2, 3, 4, 5a, 5b, and 6. For each of the stories the series of issue statements also includes an "M" statement or nonsense statement and an "A" or anti-establishment statement. The "M" statements are meaningless and are used to determine if the respondent is guessing or if the response is based merely on what appears to be impressive or intelligent-sounding phrases. The anti-establishment statements are considered to be at stage 4½.

Because the EIT deals with moral issues cast in an environmental context and because of its similarity to Rest's Defining Issues Test, the EIT can be considered to have "face validity." Nevertheless, it was considered important to establish what Cronbach and Meehl (1955) and Rest (1976) refer to as construct validity. The validation of constructs is based on indirect evidence or "construct validation" in which the theoretical implications of the constructs are tested. In this case, moral judgement is a psychological construct which, according to theory, represents different organizations of thinking. The purpose of the EIT, then, is to gather information which is indicative of the inner thought patterns and processes of the respondent.

Following the procedures established by Rest (1976), the validating criteria for the Environmental Issues Test were:

1. Test-retest stability.
2. Age trends.
3. Correlation with attitudes on current environmental issues.
4. Correlation with comprehension of moral concepts.
5. Correlation with existing moral judgement measures (Rest's).
6. Increases in moral judgment test scores after experiences which theoretically should accelerate the development of higher stage judgement.

Several groups of subjects (Ss) participated in the lengthy process of validating the Environmental Issues Test. These groups of Ss included:

40 junior high school students in grade 9

38 senior high school students in grade 12

116 college undergraduate students--juniors and seniors

Sixty of the college students were majoring in a field considered to be part of environmental studies whereas 56 were majoring in an area best described as the humanities. A more detailed description can be found elsewhere (see doctoral dissertation, Iozzi, 1976).

Scoring the Environmental Issues Test

The score one achieves on the EIT is called a "P" score. The "P" score can be interpreted as the relative importance a S gives to morally principled considerations in making moral judgments. This score is expressed as a percentage. Simply:

$$P = \frac{5a + 5b + 6}{50} \times 100$$

where the numerator represents subtotal scores from stages 5a, 5b, and 6, which are the three highest stages in Kohlberg's schema, i.e. the "principled" stages.

Test-Retest Stability

To determine the test-retest stability of the EIT, the instrument was administered to a group of 40 ninth grade students. Although it would have been helpful to include senior high and college students also, these groups of Ss were not available for two separate testing periods.

The elapsed time between the initial administration of the test and the retest was 7 days. That is, the EIT was first administered on Monday and again the following Monday at the same time, in the same classroom, by the same classroom teacher.

The test-retest Pearson product moment correlation for the EIT was .84.

Age Trends

If the EIT is valid it should, among other things, effectively distinguish among groups who because of different levels of development should also be at different levels of moral maturity. Simply, if chronological age is at least a rough indicator of overall development, then older, more educated children should achieve higher scores on the EIT than younger children.

The EIT was administered to three groups of Ss: college students, high school students (twelfth grade) and junior high school students (ninth grade). Table 1 shows how the EIT differentiated among the three groups (N=193).

TABLE 1: STUDENT GROUP DIFFERENCE ON EIT

		Stage 2	Stage 3	Stage 4	P
J H S	\bar{X}	9.75	25.17	29.06	25.30
N=39	SD	5.57	13.66	10.21	13.16
S H S	\bar{X}	9.78	19.70	29.19	37.47
N=38	SD	3.94	10.52	14.98	16.70
College	\bar{X}	8.11	15.10	27.91	50.43
N=116	SD	4.38	10.29	15.87	17.06
Environmental Science	\bar{X}	7.33	13.21	27.61	53.23
N=60	SD	4.41	6.44	16.21	15.05

Table 1 clearly shows age trends of increased use of higher stages by more developed and educationally advanced students. The highest "P" scores were achieved by the college students ($M=50.43$), the second highest by the twelfth graders ($M=37.47$), and the lowest scores were achieved by the junior high sample ($M=25.30$).

A one-way analysis of variance was computed to determine if the differences among "p" scores for the three groups were significant. This analysis yielded an F value of 37.173 which is significant well beyond the .001 level.

The scores achieved by each subgroup were subjected to further statistical analysis using the extremely conservative Scheffe method for multiple contrasts. That analysis also confirmed that the differences among means were significant beyond the .001 level.

A separate mean score was calculated for the Environmental Science majors. This group achieved a mean of 53.23, the highest mean score achieved on the EIT.

Correlation with Attitudes on Current Environmental Issues

Since moral reasoning as defined by Kohlberg is very strongly related to both moral development and cognitive development, one might question whether the EIT is actually measuring just a value-neutral intellectualizing skill only and not one that relates also to moral value commitments. If the EIT is also tapping the Ss' general environmental value system, the EIT scores achieved should correlate significantly with scores achieved using other tests that purport to measure attitudes and values in an environmental context. Since general environmental values tests cover a wide range of values and since the EIT is concerned with a specific set of values--namely, moral values--one would expect to obtain a correlation of only moderate magnitude between EIT scores and scores achieved on more general environmental attitude or value inventories.

An instrument designed to measure general environmental attitude is the Maloney and Ward Ecology Attitude Inventory (1973). It contains a knowledge subscale and an affective subscale. To determine the relationship between EIT scores and emotionality about environmental issues, the Maloney and Ward Affective Subscale consisting of 36 items was administered to a college sample of 115 Ss. (The reliability of the Affective Subscale is reported to be 0.90 using Cronbach's Alpha. Internal consistency using Scott's Homogeneity Ratio is 0.201.). Comparison of EIT scores with those scores achieved on the Affective Subscale revealed a correlation ratio of 0.36. While this correlation ratio is of a moderate magnitude, it is significant at the .001 level.

Correlation with Moral Comprehension

One might question whether subjects select higher stage issue statements on the EIT because the statements "sound good", or because preference for those statements does indeed reflect an understanding and appreciation of the greater adequacy of that stage response. Our approach to answer this question is to test the EIT with an independent measure of comprehension to see if understanding, in fact, accompanies preference for particular stage issue statements.

In validating the Defining Issues Test, James Rest showed that preference for a particular issue statement reflects understanding of the moral concepts inherent in the statement. Since all the issue statements utilized in the EIT are the same as those in the Defining Issues Test, it was deemed unnecessary to duplicate that same extensive validation process. In essence, the original validation, demonstrating that item selection does in fact tap comprehension, can be considered applicable and valid for the EIT.

Correlation with Existing Moral Judgment Measures

The Environmental Issues Test was correlated with Rest's Defining Issues Test. This comparison produced a correlation of 0.73 based on 189 Ss. This highly significant correlation supports the premise that both tests do in fact measure moral reasoning. The difference in scores achieved in the two tests demonstrate, however, my contention that people apply different levels of moral reasoning in different situations. The major difference between the two tests is that in the EIT moral issues are addressed in an environmental context while Rest's test considers more general social issues.

Increases in Scores After Intervention Which Should Accelerate Higher Stage Development

The Institute for Science, Technology, and Social Science Education which I direct at Rutgers University has produced 10 curriculum modules dealing with conflict issues at the interfaces of science, technology, and society. These modules are for grades 7 through 12 and are based in part on Kohlberg's theories. They are designed to help accelerate and increase the moral maturity levels of students. We are presently engaged in an extensive field test of these materials.

If the EIT is, in fact, able to detect gains in moral reasoning, then it would be reasonable to expect significantly higher scores after a group of Ss has been exposed to curriculum materials designed to do just that. On the other hand, we would not expect to find any gains in scores among Ss who were not exposed to such materials. While I do not have any conclusive data to report at this early stage of field testing, preliminary analysis of a small amount of data indicates that post-test scores are significantly higher than pre-test scores for groups exposed to our curriculum materials. Control groups, on the other hand, have shown no differences between pre- and post-test scores.

Conclusions

The Environmental Issues Test (EIT) seems to be a valid and useful instrument for determining levels of moral/ethical judgment for moral issues dealing with the environment. The development of the EIT, I feel, is particularly important in view of the fact that few environmental education assessment instruments dealing with affective considerations are available and none of those, to my knowledge, consider environmental concerns as moral/ethical issues.

The format of the EIT is such that aside from being useful for obtaining baseline data quickly and easily on Ss from grade nine through adulthood, it should also prove to be particularly useful in intervention studies. More specifically, the EIT should prove to be helpful for determining the extent of moral/ethical change in people as a result of using various types of environmental education programs, techniques, methods, media, and simulations dealing with the environment.

Finally, the EIT should prove to be useful for environmental education programs and for any other projects or purposes where a valid overall measure of environmental values and attitudes is required. Combining the EIT or parts of it with other existing affective measuring instruments will, I feel, result in a more accurate and complete assessment of environmental values.

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ELECTRICITY—A SAMPLE DILEMMA STORY (CONDENSED)

A large piece of land in the Southwest was bought from an Indian tribe by the Southern Electric Company. The land was bought so that six large coal burning generators could be built. The electricity produced by these stations was to be sent to several large cities in southern California. This land was chosen because it contained great amounts of coal that would be burned to produce power. It was also close enough to California so that power could be transmitted easily and cheaply.

Two generating stations were built. After they were put into operation, a group of young Indians met with the power company and the government. They complained about the great amount of smoke produced by the generators. They said the smoke was blackening the skies and endangering the lives of everyone for hundreds of miles. They were also angered because mining the coal was scarring the landscape and destroying sacred Indian grounds. They said that the older Indian leaders did not really understand what the land was to be used for when they sold it to the power company. They also felt that they were forced into an unfair agreement. The Indians demanded that the power stations be closed and the land returned.

The power company refused. The company said it was their land and that they could do what they wanted with it. The government said that the sale was legal and that nothing could be done about it. The Indians became desperate and began to make plans to blow up the power station. They felt that this would force the company to close.

Should the Indians blow up the power stations?

Yes, they should blow up the stations

Can't decide

No, they should not blow up the stations

IF YOU WERE ONE OF THE INDIANS, HOW IMPORTANT WOULD EACH OF THESE QUESTIONS BE IN DECIDING WHETHER OR NOT THE POWER STATIONS SHOULD BE BLOWN UP?

G M S L N

1. Whether laws are going to be upheld?
2. Are the Indians willing to risk getting shot or going to jail for the chance that blowing up the power stations might help?
3. Whether the essence of living is more encompassing than the termination of dying, socially and individually?
4. What values are going to be the basis for governing how people act towards each other?
5. Whether the power company deserves to be blown up for being so greedy and cruel?
6. Would blowing up the power company in such a case bring about more total good for the whole society or not?

From the list of questions above, select the four most important:

Most Important _____

Second Most Important _____

Third Most Important _____

Fourth Most Important _____

ENVIRONMENTAL EDUCATION PROGRAMS

The Environmental Education Programs section presents descriptions of six innovative and successful programs which have introduced students, educators, communities, and the nation at large to ways of understanding environmental problems, methods of developing solutions to them, and approaches for communicating knowledge about our environment to others.

C. Borgerding, *et al.*, provide a detailed description of the initial phase of the Minnesota Department of Education's highly effective grass roots, district-based plan to enhance environmental education curriculum planning for the public school. A. Curry and R. Williams describe the usefulness of wild foods workshops and activities to inform urban students about their natural environment, and to educate teachers about the potential of using wild foods as a tool for developing environmental awareness. L. Iozzi and J. Cheu generate a socio-scientific reasoning model for developing environmental education curricula from an holistic approach to the environment. They emphasize the premise that understanding environmental problems involves more than knowledge of science and technology, that a society's attitudes, values, and cultural standards must be understood if the causes of environmental problems are to be fully comprehended and solutions to them intelligently sought. T. Teich, *et al.* stress the value of community based environmental education for adult target audiences, and cite several efforts in Western Pennsylvania as illustrations of successful environmental education programs. H. Morris examines the role conservation districts currently play in environmental education, and argues for developing closer ties between higher educational institutions and conservation districts. Finally, H. Moore describes the commitment of the Department of Interior to environmental education and its program to work with higher education at both the national and regional level. Moore underscores the fact that the support for this effort stems from President Carter's recognition of the systems nature of environmental problems, and the need to educate the nation about this reality.

Though the articles range from the theoretical to the practical, in general they deal with the broad area of developing effective "delivery systems" for instructing students about environmental matters.

DESCRIPTION OF THE TWO-YEAR INITIAL PHASE OF THE ENVIRONMENTAL EDUCATION CURRICULUM PLANNING PROJECT

² Carmen Borgerding, ³ John Comstock, ⁴ Arlyn Kline
⁵ John Miller, ⁶ Douglas O'Brien, and Donald Wagner

In June of 1977 the Environmental Education Curriculum Planning Project ended a two-year initial phase. The Curriculum Planning Project was the major environmental education thrust of the Minnesota State Department of Education over the two year period and is the subject of this report. It came to be called The Project by those participating in it, and it will be identified by that term throughout this report.

Because this report deals only with the initial two-year phase of the Project, it is written in the past tense. That does not mean that it is finished; the Project is continuing and evolving.

HISTORICAL BACKGROUND

In 1969, the Minnesota Legislature enacted Environmental Conservation Education Statute Chapter 126.111 for the purpose of preparing an interdisciplinary program of instruction for elementary and secondary schools in the area of Environmental Education. The responsibility for developing the instructional program became the joint endeavor of the State Department of Education and the Department of Natural Resources. Initially, the two departments developed thirteen experimental units on environmental education for grade levels K through 12. These units, tested in twelve pilot school districts throughout the State during the 1970-71 academic year, became the basis for forty interdisciplinary mini-units which became available to any school district without cost if the school district agreed to have their teachers in-serviced in the philosophy and classroom use of the materials. Beginning in the summer of 1972, a state-wide effort began between the Departments of Education and Natural Resources and institutions of higher education to in-service interested school districts. Between 1972 and 1975, several hundred districts and thousands of teachers were in-serviced in this program.

During the 1974-75 school year, a study was made by the State Department of Education in an effort to ascertain the relative effectiveness of the mini-units as an instructional aid for teaching environmental education. The results of the study indicated that although the mini-units did enhance the curriculum and provide a base as an instructional tool, several limitations existed, resulting in a fragmented environmental education program. The limitations found included: a) use of only those mini-units in which the teacher was in-serviced, b) a lack of understanding by the teacher in how to incorporate the mini-unit content into the existing curriculum, c) the inability of the teacher to develop curriculum materials that went beyond the scope of the mini-units.

It became obvious at the conclusion of the study that there was an immediate need to provide teachers with assistance in the process of planning a more total and comprehensive environmental education curriculum.

¹ Inquiries about the Project and about the availability of materials developed during the initial two years may be directed to John Miller, EE Coordinator, State Department of Education, 550 Cedar Street, St. Paul, MN 55101.

² Minnesota Environmental Education Board.

³ Minnesota Department of Education.

⁴ Mankato State University.

⁵ Wayzata, Minnesota, Public Schools.

⁶ Jenny Publishing.

The State Department of Education contracted with the Minnesota Environmental Sciences Foundation Incorporated (MESFI), to produce a guide for planning a more complete environmental education program. The guide attempted to de-emphasize the role of science in environmental education by asking teachers to examine all of the basic content areas and incorporate environmentally related activities into them. As a means of helping teachers in this examination four contexts were defined and a simple matrix was developed for their use.

The guide defined the four contexts as follows:

1. Natural Context: That learning which is most related to non-human-dominated communities and their physical habitats including, e.g., soils, atmospheric and hydrologic systems, animals, plants, distribution and abundance of organisms, decomposers and decomposition processes, nutrient and mineral cycles and energy systems.
2. Social Context: That learning which is most related to human social, economic, political, cultural, ethical and psychological systems.
3. Valuing Context: That learning which is most related to choosing freely from a thoughtful consideration of alternatives, becoming aware of what we cherish and affirming these choices by connecting them to our own behavior. It is important to recognize that values should always be open to change with new information and understanding. Values clarifying questions are "you" questions. What did you learn that was important to you? What does it mean to you? What difference has this made in your life? How do you live differently as a result of what you have learned or experienced?
4. Action Context: That general realm of learning experience which relates to the processes through which alternative responses to concerns are weighed before solutions are developed and tested. Action, or the decision for no action, should result from individual choice.

The matrix illustrated here serves as a guide for integrating contexts and content areas:

CONTEXTS

CONTENT AREAS

	Math	Science	Language Arts	Social Studies	Other Disciplines
Natural					
Social					
Valuing					
Action					

In piloting these program planning ideas, it soon became obvious that planning an interdisciplinary curriculum was not totally understood by the average teacher; thus, it was necessary to provide additional assistance to school districts to accomplish this task. After consultation and the formation of a Project Team, we began the Environmental Education Curriculum Planning Project.

Nineteen schools were selected, from applications, to develop a variety of "grass roots" curriculum planning projects. At least one school was chosen from each of the 13 state regional development areas, thus assuring that the participating schools were dispersed throughout Minnesota.

Requirements for participation were kept to a minimum. The schools only had to agree to form a steering committee which would include an administrator and a wide a range of representation from subject and grade areas as workable, to begin to meet and plan; to make a long-range commitment to environmental education beyond the life of the Project, and to demonstrate school board support in the form of \$500 of district funds to match the \$500 provided by the MDE planning grant.

PROJECT DESCRIPTION

The initial phase of the Project had as its primary goal the initiation or improvement of environmental education programs in school districts. The best means of accomplishing this goal was judged to be helping individual districts plan and implement their own programs.

Some assumptions are implied in the organizational structure of the Project discussed below: That local planning will be most likely to cause long-term commitment to environmental education; that local self-reliance is more likely to happen if there are fewer directives imposed; that local self-reliance and few directives will mean great diversity in program plans and equally great diversity in needs and problems; that the greater the diversity in needs and problems the more efficient and effective the communications between parts of the organization will need to be.

THE PROJECT ORGANIZATIONAL STRUCTURE

The organizational structure consisted of a state-level group of six environmental educators called the Project Team, a Facilitator Team made up of ten people assisting the participating school districts in an advisory capacity, and 19 local steering committees charged with the actual environmental education planning in their individual school districts.

The Project Team, all of whom were also facilitators or members of local steering committees, met once a month to provide coordination and guidance. The Facilitator Team became the major communication link between parts of the organization. The local steering committees were the work teams who planned and began to implement environmental education programs in their districts. They produced 19 unique projects.

THE PROJECT PROCESS

The central and pivotal feature of the Project process was facilitation. When the decision was made to aim for variety and diversity in project results, it was assumed that there would be great diversity in the resource needs of the participating districts and great unpredictability. The Facilitation mode was chosen as the best means to achieve the results hoped for, because the spirit of facilitation is cooperation and assistance. The unpredictability and variety of resource needs call for good communication skills, resourcefulness and flexibility in the facilitator, and great predictability and responsiveness in the support system standing behind the facilitator.

The support system which backed up the Project facilitators included a variety of resources, both resource people and resource materials, and a feedback system that included monthly, mid-year and year-end reports and semi-annual conferences.

As part of the process a model was developed to suggest a logical sequence for developing local program plans. This framework was called the O.A.P.I.E. model (Organization/Assessment/Planning/Implementation/Evaluation). The parts are described here:

Organization: Organizing usually involved forming a district steering committee which met regularly and assumed the major responsibility for curriculum planning. The committee was to consist of both administrators and teachers representing diverse grade levels and subject areas. A shared decision-making process was strongly recommended with a free and open atmosphere that promoted trust and sharing.

Assessment: In order to begin planning, the steering committee often needed to survey district staff to identify individuals with specific EE interest and skills, and existing EE instruction and resource needs. This information was crucial for effective curriculum planning and often uncovered the need for special efforts such as in-service experience through higher education, workshops, or courses.

Planning: Discussions led to decisions about what, how and where EE would be taught in the school district. The facilitator helped us demonstrating planning techniques to help assess EE curriculum materials and match or integrate them with instructional programs in the district. The curriculum plans had to be understandable and capable of being implemented with students.

Implementation: An implementation plan was determined by the curriculum plans. EE programs vary from district to district for many reasons: difference in resources, teaching environments, staff interests and skills are just a few.

Evaluation: What was identified as useful and valid evaluation also varied from district to district. However, beyond the variations, it was important to assess the effectiveness of EE experiences in terms of student outcomes and to identify how EE programs could be improved.

Figure 1 provides a visual way to view how the O.A.P.I.E. model functioned within the Project facilitation process. The diagram indicates that the parts of the model overlap, and that evaluation is a part of each of the steps.

The facilitators provided the link between the Project Team and the local steering committees which kept cooperative assistance flowing in both directions. Identification of resource needs was relayed to the Project Team, and project resources were relayed back to the local steering committees. The local steering committees, in turn, became Project resources for the Project Team and for one another.

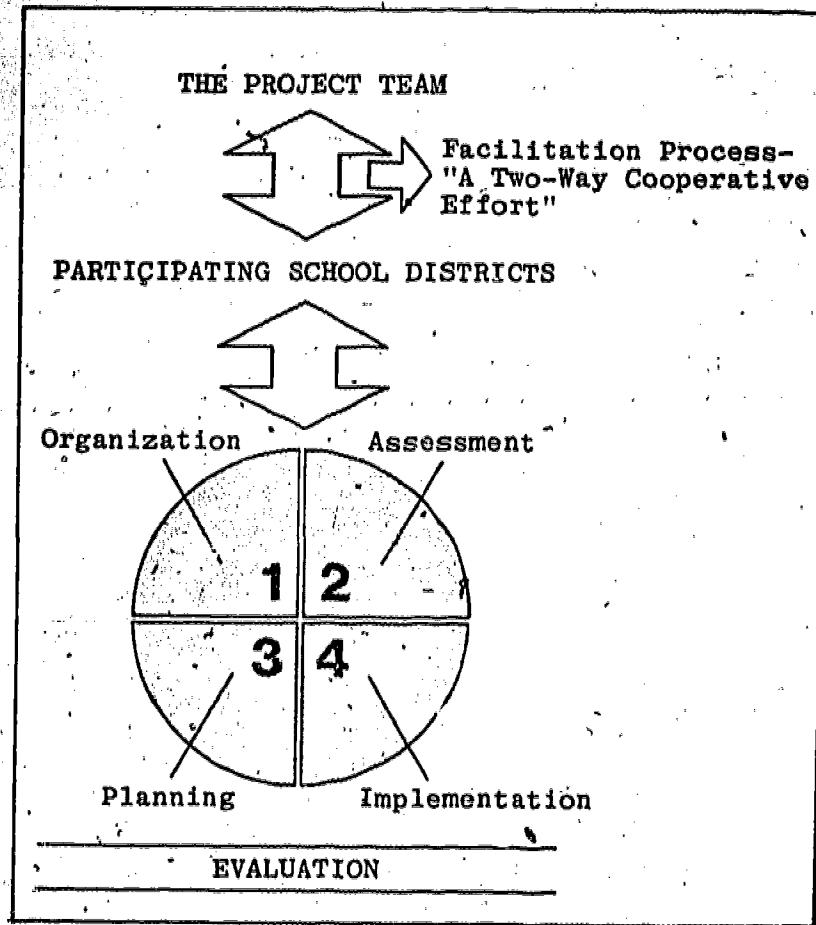
Figure 2 illustrates the Project process discussed above. It shows the cooperative assistance process used in facilitation to unite efforts and resources in order to effect the Project goal of initiating and/or improving environmental education programs in school districts.

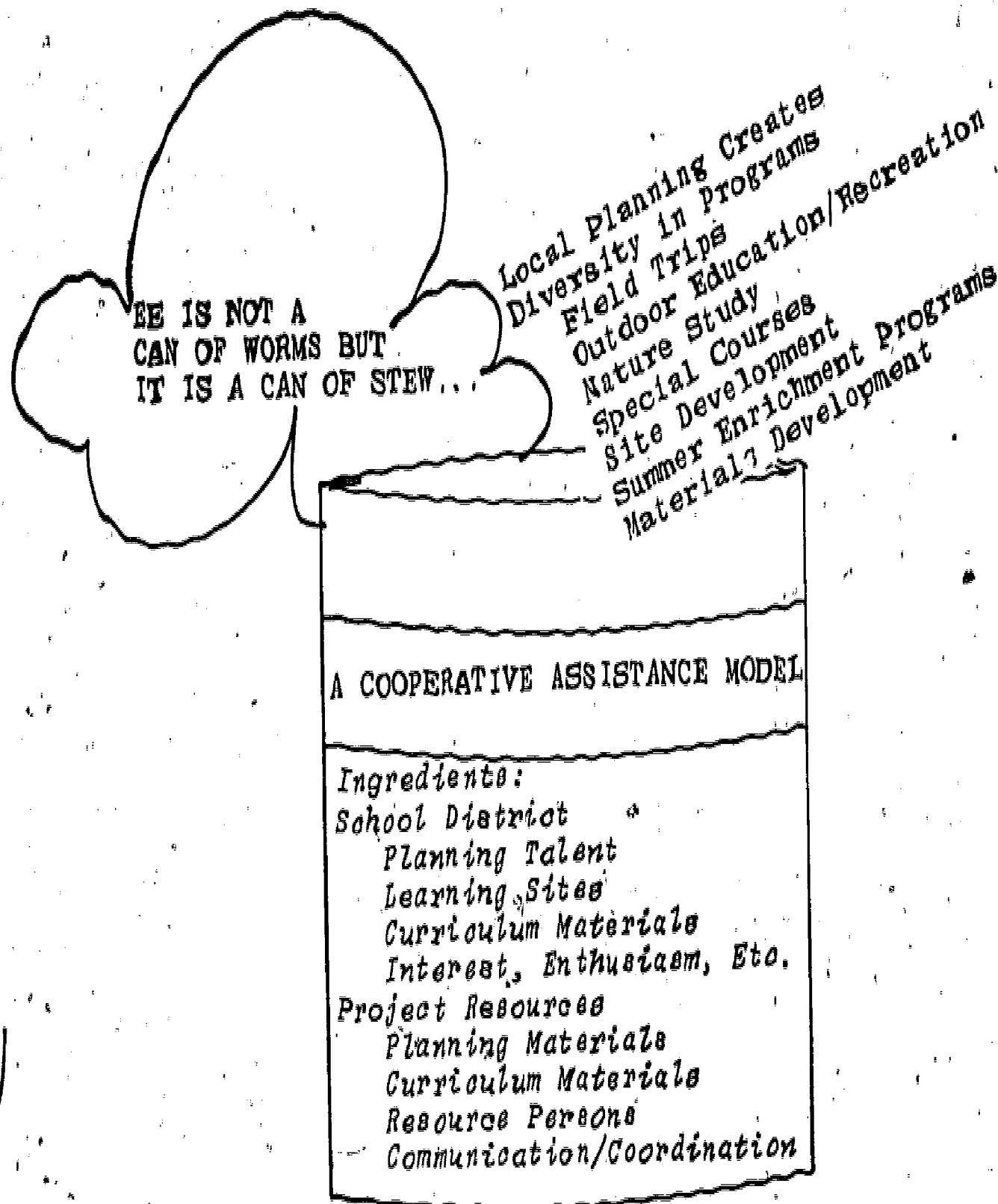
SUMMING UP PHASE I

The material which follows describes some of the specific events and vital aspects of the Project which have been only alluded to earlier. It refers again to the organizational structure and process aspects. Each description is followed by summary statements evaluating the results of the Project. Some things worked well, some things not so well, and some things better than anyone had hoped for.

In general, the Project's success was outstanding. Much environmental education planning resulted; valuable print materials were developed in great variety and abundance; long-term commitment to environmental education has been made in almost every participating district; environmental education leadership was identified in some instances, and developed in others, and will be a resource for Minnesota schools to draw upon in years to come; many districts put many more than the required matching dollars into their projects. The great variety of programs which resulted is evidence that participating districts were well-served and successful in being helped to rely on their own creativity and their own priorities.

Figure 1. Project facilitation using the O.A.P.I.E. model





CONFERENCES

Mid-year and year-end leadership conferences were held in both Year I (1975-1976) and Year II (1976-1977) of the Project. Mid-year conferences were located regionally, one in the north and one in the south, so that participating districts did not have so far to travel. At the year-end conference, all participating districts met at one central location. Agendas for all conferences were prepared by the Project Team and mailed to districts in advance of the conferences. In general, mid-year conferences were planned to provide a forum for interim progress reports, while the year-end conference was planned for sharing summary reports.

The first pair of mid-year conferences were held in February, 1976: the northern conference at Bald Eagle Outdoor Learning Center, Bemidji, and the southern conference at Camp Courage, Maple Lake. Since these were the Project's initiating conferences, introductory material was the conference content - an overview of the Project's origins, goals, and potential products; an explanation of the Facilitation Model and its rationale; and a description of process items such as time lines, and dollar requirements. An evaluation form accompanied each step of the conferences in order to provide the Project Team with the participants' critiques.

The year-end conference for Year I was held at Long Lake Conservation Center in June 1976. One or two persons attended from each participating district. In addition to sharing end-of-year summary reports with one another, participants also chose among mini-sessions. Session topics had been selected to match and support the character and variety of the developing individual district programs. Choices included: outdoor site planning and development, the Environmental Conservation Library of Minnesota's (ECOL) bibliography of environmental education materials, and environmental education curriculum planning approaches and problems.

Year II began with a special, once-only conference for facilitators, held at the Northwoods Audubon Center near Sandstone. The facilitators reviewed all written material from Year I and shared strategies for Year II.

Mid-year conferences for Year II took place at Bald Eagle Center and Camp Courage in May 1977. Districts reported, reviewed and evaluated together.

The year-end conference was the final one for the project. It was held at Camp Courage in May 1977. Because this was the last gathering for many of the districts, the agenda was planned to offer a range of resources which districts might draw upon in the future after the support of the Project was withdrawn. Special sessions were offered on Minnesota's Planning, Evaluation, Reporting (P.E.R.) legislation; Minnesota Pollution Control Agency; conducting a successful teacher-environmental education workshop; environmental education for urban schools; district-wide site planning; and others.

Results: Gathering people together to share with one another their parts of a joint undertaking assures a spirit, warmth, and caring that reading reports cannot accomplish. Face-to-face it is possible to share enthusiasm, ideas, frustrations and solutions. These things happened over and over. Settings were chosen for their physical isolation so that participants would be encouraged to socialize with one another. Recreation opportunities were provided such as swimming, hiking, and cross-country skiing to make it additionally attractive to remain together after hours. Very effective, informal communication resulted.

FEEDBACK SYSTEM

Whereas conferences offered a reporting forum where dialogue could also occur, monthly reports were the means of documenting step-by-step progress or lack of it. Extensive forms were developed which were linked to the O.A.P.I.E. model described earlier. A separate color was chosen for each part of the model, enabling readers to locate information quickly. The intent was to make reporting as easy and fast as possible for the districts and at the same time pre-organize information for the Project Team.

Some districts were dissatisfied with the reporting system, and, in the style of the Project, they were allowed to choose an alternate means of reporting -- phone in, minutes of meetings, reports, etc.

Results: The color-coded reporting system had mixed results. Many districts used the forms with good success. However, unforeseen things seemed to necessitate certain changes. First, some districts complained that what they wanted to report did not always match what the forms asked for. Then, many districts found that they did not progress along the O.A.P.I.E. model as fast as predicted, e.g., organization may have taken three months instead of one, but only one form dealt with the subject of organization. Finally, the model itself raised questions of interpretation in several districts.

FACILITATORS

One of the most successful aspects of the project was the facilitator concept. Each participating district had an environmental educator as a resource person to help the district in a variety of ways.

Facilitators were selected to help local steering committees to identify their objectives and meet them. They had wide knowledge of resource materials and resource people. They offered suggestions and support when needed, and they followed a "hands-off" approach when it seemed better for the local steering committee to rely on its own problem-solving resources.

Some of the ways in which facilitators served their districts were teaching courses for college credit, helping to write proposals, helping to inventory curriculum for environmental content, conducting curriculum writing efforts, and helping find and plan for outdoor sites.

Results: Overall, the reaction to the Facilitation Model was enthusiastically positive. Most districts felt that their individual and unique situations had been understood and supported by their facilitator.

A few less positive situations existed. In some cases facilitators had as many as three districts and found themselves spread too thin. For those facilitators, some difficulty arose in attending all steering committee meetings. In other cases there were missed expectations when the facilitator did not or could not provide the help a planning team wished, e.g., when a local steering committee wished their facilitator to be their clerical component. In most instances, such misunderstandings were resolved.

LOCAL STEERING COMMITTEES

Local steering committees were the heart, strength, and work force of each district's project effort. Great care was taken at the outset to assure that a good mix of people was represented on these committees, i.e., someone from administration, representatives of several subject areas, and representatives of several grade levels. In practice, districts actually did adhere to these suggestions, and added community members in some cases. Of course, the state facilitator became a member of the committee. The number of members on

each committee varied from as few as four to as many as seventeen.

Besides the primary function of making environmental education planning happen, the local steering committees had the responsibility of communicating their activities to the State Planning Committee and other participating districts via monthly reports, mid-year progress reports, end-of-year summary reports, and oral reports at conferences; in addition they budgeted and billed.

Results: These committees were the sine qua non of the Project. Where committees were strong and committed, much activity went on. The hunch turned out to be correct that committees should include administrators. Active administration involvement made for more effective activity.

Perhaps the most positive result of the committee structure and the factor holding the most promise for the future of environmental education was the spirit developed within the groups. Close, spirited, tough, committed groups resulted from the shared struggle with their projects.

THE PROJECT TEAM

The Project Team was organized to function both as an advisory body to the State Department of Education -- Environmental Education Unit, and as a task force for the Project. The Project Team met monthly to plan agendas for the variety of meetings and conferences, to respond to reports and evaluations, to supply the back-up resource staff for district problems as identified by their facilitators, and to provide other resources.

THE FUTURE

The Project will continue much as described here for at least the current school year, 1977-78. The only major change is that the planning grants to school districts will come from the Regional Environmental Education Councils rather than MDE. In the fall of 1977, the REEC's have had much to do with the selection of participating districts. The Project Team will continue to offer the coordination and the process will be much the same, including conferences and a reporting system. The future beyond mid-1978 is uncertain for the individual school projects.

Seven of the original nineteen schools have agreed to be contact schools. These seven were chosen because they are exemplars of the various kinds of programs that emerged from the Project. The contact schools have agreed to answer requests for information about their programs, and will make some printed materials available. The seven schools and their programs are: WAYZATA: Development of a K-12 teacher in-service program; WYKOFF: Elementary summer awareness program; GRAND RAPIDS: taught by an interdisciplinary team; ALBERT LEA: A three pronged program which (1) explores a small town from an environmental viewpoint, (2) a wilderness experience (the Gunflint Trail), (3) a problem-solving experience, i.e., an information collecting experience as part of the solving of environmental problems; MONTEVIDEO: K-12 curriculum development; SLAYTON: K-12 curriculum planning and development; and CENTENNIAL CIRCLE PINES: Development of six environmental education sites, K-12 environmental education program.

The descriptions of the seven contact programs described above were entered into the SYSMAIL information-sharing computer program available to Minnesota schools through the Minnesota Educational Computer Consortium (MECC).

The Project, after mid-1978, will probably change a great deal. The Department of Education's EE Unit and MECC have written a proposal to attract funding for a computer-based program which would have the potential for meeting more of the needs of the 437 school districts in Minnesota. The abstract or their proposal is reprinted here:

Proposal Title: The Application of Computer/Telecommunication Technology to Environmental Education Program Planning

Description: The basic goal of this project is to utilize computer and related telecommunication technology to support and enhance the development and implementation of environmental education programs at the local school district level. Specifically this project will (1) increase communication between local environmental education program planners and Minnesota Department of Education curriculum coordinators using Minnesota's state-wide telecommunications network, (2) provide access to on-line, computer information storage and retrieval containing information which computer-based curriculum planning assistance can be provided to local level environmental education curriculum planners.

LIVING OFF THE LAND — AN URBAN FORAGING EXPERIENCE

A. Dudley Curry and Robert A. Williams¹

This paper has the dual purpose of 1) explaining one important role of wild foods activities in connection with what we call environmental value education, and 2) describing a wild food teacher workshop that we have found through practice to be fruitful for teachers to use with their students or in training other teachers. The idea of "living off the land" is more symbolic of our thrust than expressive of our real hope. We do not expect teachers or students to literally live off the land as our ancestors did. We do believe, however, that wild food activities can have a very important role for the urban student in providing for the development of environmental awareness and values.

I. WILD FOOD EXPERIENCE AND ENVIRONMENTAL VALUE EDUCATION

Value education, generally speaking, can center in three broadly conceived relationships: 1) man-man, 2) man-nature, and 3) man-God. Environmental value education has its center in the man-nature relationships. It encompasses at least both esthetic and ethical experiences and subject matters. The ethical aspect requires both cognitive and sensory activity, and we believe that the sensory side has been underemphasized in contemporary environmental value education theories and strategies. We further believe that the perceptual/esthetic-type experience is prerequisite to the meaningful environmental ethical development of youth. In particular, the group which will benefit from the wild food experience will be urban children whose experiences with the wild might be limited. These natural contacts, which can be conducted in the urban setting, can provide direct sensory experiences which will help furnish an adequate grounding for conceptual and judgmental development in man-nature relationships.

The present concern of many naturalistic thinkers seems to center, as it should, on new man-nature relationships made prominent by recent environmental crises such as pollution and over-population. The newly-recognized importance of non-human/organic life as it is being seen through the science of ecology has focused concern on these man-nature relationships. This recognition has taken positive ethical thought full circle from the theorizing of ethical naturalists like Herbert Spencer,² who advocated, in accord with the Darwinian theory, "survival of the fittest" as the basic natural law of morality, to the thinking of many contemporary conservationists and naturalists who are now concerned with preserving weak and threatened species. Survival of the most unfit may have taken the center stage. The new direction is more in keeping with the thinking of Albert Schweitzer³ and his "reverence for life" position.

In our view, the history of Western theorizing about the man-nature relationship may be reaching a crucial crossroad. Ethical theorizing in Western civilization has been centered in the man-man and man-God relationships. The man-nature relationship is now assuming a new importance in the realm of ethical and moral concerns.

Our major point in this part of the paper is that sensory experience is an essential element for eliciting meaningful man-nature values development. This recognition of a need for a sensory experience is simply a reassertion of the connection between experience and conceptual development that John Dewey⁴ and others made evident in educational theory decades ago.

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² Herbert Spencer, Principles of Ethics, Vol. 1, New York: D. Appleton and Company, 1892.

³ Albert Schweitzer. Out of My Life and Thought, New York: Mentor Books, 1955.

⁴ John Dewey. Human Nature and Conduct; An Introduction to Social Psychology, New York: Modern Library, 1930.

A. Environmental Value Education Models: Because value education centering in the man-nature relationship has been a growing concern of environmental educators for several years, numerous strategies and models have been proposed and utilized at all levels of education. John C. Miles⁵ described three major kinds of value education: 1) the "Values Clarification Approach" of Raths, Harmin and Simon; 2) the "Banks Values Inquiry Model" of James A. Banks; and 3) the "Moral Reasoning Model" of Lawrence Kohlberg. Miles believes these three major value education approaches applied in the environmental problems area have been effectively used and are not mutually exclusive. He suggests using the three approaches in the "preparation, implementation, and evaluation of environmental education materials." We find the underemphasis on perceptual experiences to be a common shortcoming in all three approaches and also in a fourth approach that we believe should be added to the list of major environmental value education approaches.

This fourth approach is the "games or simulations approach." All manner of games centering on environmental problems, situations, and conditions have been devised, published, and used. Many of them contain elements of the approaches described by Miles, but those relationships are not always deliberately or consciously achieved by the game inventors.

The purposes of the games vary widely. Some set out to teach ecological concepts, others involve the students in making group decisions concerning environmental problems. The imagined decision-making groups vary from the family group to civic, social, government, business, conservation, and naturalist groups. The decision-making processes vary greatly in their forms, although the general trend is for the games not to be grounded in a theory of decision-making. It would seem that there is a widespread faith by game makers that group decision-making automatically leads to good consequences.

A fairly comprehensive annotated bibliography called *Games for the Science Classroom* has been authored by Paul B. Hounshell and Ira R. Trollinger⁶ and published by the National Science Teachers Association. Some of the titles of the games in that work are indicative of the subjects they address: "Make Your Own World," "The Dead River," "The Planet Management Game," "The Redwood Controversy," "Gomston--a Polluted City," and "Balance." The game "Balance," for example, ideally takes fifteen one-hour sessions, and comes complete with objectives booklet, sequence chart, description of major issues, rules, essay evaluation instrument, and an attitude survey instrument. It is described in part as follows:

Balance is a simulation of four families that live in the imaginary town of Ecopolis. Each family faces a major ecological dilemma: air pollution, water and power, land use, and population. Each student plays a member of each family during the game and the issues are considered during the role-play. A "Family Decision Form" is filled out after each group plays a particular family. Decisions are made from the facts presented during the role-play and students are awarded points at the end for their decisions. An essay evaluation concerning the four dilemmas is given at the end.⁷ (p. 35).

Hounshell and Trollinger also summarize the many rationales that are usually given for gaming. Briefly, games are held to have the values of 1) teaching factual knowledge, 2) increasing student's critical-thinking and decision-making skills, 3) enabling the making of "real-life" decisions without suffering severe consequences, 4) possible better knowledge retention, 5) high motivation through fun, 6) switching teacher role from source to facilitator of knowledge, 7) causing understanding of relevance of information, and 8) possible

⁵ John C. Miles. "The Study of Values in Environmental Education," The Journal of Environmental Education, 9, 2 (Winter 1978), pp. 5-16.

⁶ Paul B. Hounshell and Ira R. Trollinger, Games for the Science Classroom, National Science Teachers Association, Washington, D.C. 1977.

⁷ *Ibid.*, p. 35.

positive attitude changes in students. This last point -- attitude change -- clearly puts such games in the value education arena.

Games, then, have to be counted a major approach to environmental value education. Games, however, since they are grounded in simulations and vicarious experience, have the same shortcoming we see in the three major approaches identified by Miles. They do not make explicit provision for an immediate or sense experience base which will make the analytic or evaluative experience meaningful. Without a sensory experience base, much significance will be lost from attempts to engage the student in any of the major approaches. We believe that the urban child has usually had insufficient man-nature sensory experience to develop real and lasting environmental values, and it is to this experience base that we believe wild food activities can contribute.

Thinking, deciding, reflecting, relating -- these are cognitive activities which are promoted by the four major approaches, but we believe these cognitive operations must have perceptual value-data to make them useful in making meaningful value judgements. We suggest that urban wild food activities can help furnish the experience base essential to the fruitful use of current value education approaches. (For the full range of uses we see for wild food experiences see references 6 and 7.)

II. WILD FOOD WORKSHOPS

Our purposes in this part of the paper are twofold: First, to provide a step-by-step view of how to organize a workshop yourself; and second, to provide a list of equipment and supplies needed for accomplishing a wild food project in the school setting.

Urban gathering sites are our special target. In the inner city, supplies of different varieties of edible plants grow in backyards, alley ways, vacant lots, curbing right-of-ways, and untended parks (or even tended parks, for that matter). Searching the earth at such sites and handling, smelling, tasting, digging, planting, cooking, and eating are all activities that suit the impulses of the young, no matter if they are city dwellers or from the countryside.

The workshop format has five stages: 1) There is the introductory phase in which the workshop participants are presented with (a) the philosophy which states our purposes and values, (b) an overview of the educational uses of wild food activities, (c) cautions concerning the use of wild food, (d) handouts, including a bibliography, recipes, equipment and supply lists, and (e) a descriptive preview of the collecting field trip. 2) The collecting field trip is then undertaken. This should be done in suitable area close to the meeting sites. 3) Upon returning to the meeting room from the collecting field trip, clean and prepare the plants for eating. You will need the proper utensils and access to a sink and water. 4) When the food is prepared, the workshop participants sample all the foods. 5) Finally, the workshop directors summarize the activities and presentations that have occurred, and enlist participants in the clean-up which puts the meeting site back in shape.

Some special cautions should be exercised by urban food gatherers.⁸ Briefly stated as rules, they are 1) wash your plants with extra care; 2) in dirty areas use only plants that will be cooked; 3) avoid gathering in areas where insecticides have been used; 4) avoid gathering in heavily industrialized areas; 5) where heavy automobile use is apparent, gather only young and fresh plants.

An outline of the workshop format and a list of material needed are provided in Appendix A and B respectively. Accomplishing a wild food workshop entails a healthy amount of preparation of both hardware and software. There is preparation that must take place before you leave for the workshop, and there is preparation to be made at the site.

⁸Curry, A. Dudley, and Robert A. Williams. "Special Cautions for Urban Food Gathering," The Journal of Environmental Education 9, 2 (Winter 1978), pp. 18-19.

APPENDIX A

OUTLINE

I. Presentation Format

- A. Introduction
 - 1. Philosophy
 - 2. Overview of uses
 - 3. Cautions
 - 4. Handouts
 - 5. Preview of collecting field trip
- B. Collecting Field Trip
- C. Food Preparation
- D. Eating
- E. Summary and Clean Up

II. Preparation Before You Go

- A. Collect food to be taken along
 - 1. Greens - Precook and freeze
 - 2. Mushrooms - Pick and freeze or dry
 - 3. Teas - Collect and prepare and dry
 - 4. Salad mix - Collect and wash and chill
 - 5. Fruit or nuts - Collect and store
 - 6. Bake bread or desserts
- B. Collect cooking paraphernalia
- C. Collect cooking and serving supplies
- D. Prepare library of cooking and gathering
- E. Prepare bibliography, recipes and other handouts

III. Preparation when you get to workshop site

- A. Survey area for collecting spots
- B. Locate water supply, electrical outlets, garbage facilities and kitchen area
- C. Move and set up equipment prior to workshop time
 - 1. Start teas
 - 2. Thaw and heat greens
 - 3. Heat water for newly-collected greens
 - 4. Arrange display and serving tables
 - 5. Set up display materials and handouts

APPENDIX B

MATERIALS

I. Cooking Equipment

- A. Five (5) knives - cleaning and cutting greens
- B. Three (3) spoons - stirring and serving
- C. Two (2) tea kettles - two kinds of tea
- D. Three (3) sauce pans - heating frozen greens
- E. Large cooking pot - cooking greens
- F. Pie tins - serving various foods
- G. Salad bowl - salad cleaning and mixing
- H. Two (2) pails - collection and cleaning food
- I. Electric frying pan - mushroom and green cooking
- J. Three (3) hot plates and/or Coleman stove
- K. Plastic sacks - collecting and garbage

II. Serving Materials

- A. Paper plates
- B. Paper cups
- C. Plastic forks and spoons
- D. Paper napkins

III. Cooking Supplies (Basics)

- A. Salt and pepper
- B. Sugar
- C. Vinegar
- D. Oil
- E. Butter or margarine

IV. Food Used

- A. Greens
- B. Teas - sassafras - mint - sumac
- C. Mushrooms
- D. Salad mix
- E. Jerusalem artichokes
- F. Pie or bread
- G. Wild fruits or nuts

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INTERFACING SCIENCE, TECHNOLOGY, AND THE SOCIAL SCIENCES: A HOLISTIC APPROACH TO ENVIRONMENTAL EDUCATION

Louis A. Iozzi and Janey Cheu¹

Introduction

On the news the other day it was announced that a major car manufacturer was ordered to recall a particular line of cars because of inadequate pollution control devices. Following this report, the scene shifted to a dealer's showroom where a customer was in the process of purchasing the car in question. When asked why he was buying the car despite its violation of pollution control standards, the reply was, "I happen to like the style and the power. I buy a car for my comfort and enjoyment. I want a car that will perform. Air pollution is not my concern."

This type of egocentric thinking and self-serving behavior illustrates vividly one of the overriding factors contributing to our increasing environmental deterioration and dislocations. Environmental problems, as we know, are not merely scientific and technological in nature, but are inextricably intertwined with value priorities and value decisions. Therefore, environmental education must address these issues.

We all recognize that environmental problems are not only those confronting us today--those of existing pollution, land use management, and energy concerns--but potential problems that may very well threaten human survival. The effects of increasing environmental degradation and increasing demands on limited natural resources pose problems of immense proportions and intricate complexity for our future citizenry. It appears, then, that the challenge to environmental education is to assist our students in becoming more effective and wise, responsible decision makers, individuals who will address problems from a perspective beyond limited self-interest. Unlike our "hunting and gathering" ancestors, the kinds of decisions we make today in a highly interdependent world have far wider impacts and are capable of producing dangerous consequences tens of thousands of years hence.

Environmental awareness and knowledge are only two aspects of this educational goal. Equally important, we feel, are moral and ethical considerations. As Barry Commoner (1972, p. 198) pointed out:

...no scientific principle can guide the choice between some number of kilowatt hours of electric power and some number of cases of thyroid cancer, or between some number of bushels of corn and some number of cases of infant methemoglobinemia. These are value judgments; they are determined not by scientific principles but by the values we place on economic advantage and human life...
These are matters of morality, or social and political judgment.
In a democracy they belong not in the hands of experts but in the hands of the people and their elected representatives.

Theoretical Rationale

We at the Institute for Science, Technology, Social Science Education, therefore, view environmental education as the development of those skills necessary for complex environmental problem solving. Moreover, because the value component has such significant ramifications, environmental issues are in essence moral/ethical issues in a scientific, technological and social context. We do live in a highly technological society, and as a result, environmental education should reflect that orientation.

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The goals of development, we believe, should contain the following components:

1. Increased skills in dealing with problems containing multiple interacting variables.
2. Increased decision making skills incorporating a wider social perspective.
3. Increased critical thinking in the evaluation of consequences and implications.

The question is how to best approach the development of more complex and comprehensive problem solving capabilities. What is the best approach, particularly in the area of values?

Let us first examine some of the values education strategies commonly employed. The values inculcation or indoctrination approach, such as in "character" or "socialization" education, is limited to the values we can agree upon. We can value conservation and thus campaign for turning off unnecessary lights or stop dripping faucets. But in areas of conflict, such as choosing between preservation of pristine natural lands and strip mining to meet our energy needs, how should the dilemma be resolved? Whose values should prevail? Alternatively, we could employ a values clarification approach in which values are examined and clarified so that each individual gains a better understanding of his/her values system that guides the selection process. Again, we believe, this approach is limited because its strategy does not allow for evaluating particular judgments. The view is that value judgments are neither "right" nor "wrong," for right and wrong are relative to an individual's own value system. In effect, each value system has equal merit. If a value system that bases priority on personal comforts and luxuries predominates; how can we begin to address issues of resource depletion, land mismanagement, and equity in distribution of scarce resources?

For us, the more appealing approach is that offered by Lawrence Kohlberg, whose ideas stem from the philosophic tradition of Socrates, Plato, Dewey and Piaget. The emphasis here is on education to help individuals grow both intellectually and morally. This, we believe, is perhaps more functional than arbitrary indoctrination of values or taking a values relativity stance.

Development of reasoning from childhood to adulthood is viewed as progression through discrete stepwise stages. At each successive stage one's concerns take on a broader perspective. Stages are not skipped nor does regression occur. That is, each stage is characterized by a very different way of experiencing and interpreting those experiences. At Kohlberg's Stage "2", for example, "right" and "wrong" is judged in terms of satisfying one's own needs and sometimes the needs of others if it is convenient to do so. Stage 3 reasoning centers around maintenance of approval in one's own social group. The orientation is towards conformity to group expectation. At the higher principled stages, reasoning takes into account concerns for welfare of others in a broader context, and includes concerns for human dignity, liberty, justice and equality--those principles on which our Constitution is based.

Kohlberg's cognitive moral/ethical development theory is closely linked to Piaget's intellectual developmental theory. Development is viewed not as mere accumulation of information but changes in thinking capabilities--the structures of thought processes. In the course of development, higher level thought structures are attained, extending one's social perspective and reasoning capabilities. Applying higher levels of thinking to problems results in problem solutions that have greater consistency and generalizability.

Typically, this developmental approach has been employed successfully in a social studies education context (Fenton, 1975), but can be readily adapted to environmental education in which social issues are an important concern.

The Socio-Scientific Reasoning Model for Environmental Education

Combining our own philosophy, ideas, and research with the theories of Piaget and Kohlberg, we have developed what we call "the socio-scientific reasoning model." Socio-scientific reasoning is the incorporation of the hypothetico-deductive mode of scientific problem solving with the social and moral/ethical concerns of environmental decision making. This model has served as our guide in the development of those appropriate educational materials to help students advance to higher levels of thinking and reasoning capabilities. It is highly flexible and readily adaptable to other curriculum development efforts.

The basic assumption of this model is that effective problem solving in environmental issues requires simultaneous development in the realm of logical reasoning and social moral/ethical reasoning. The pure objective scientific thinking cannot not be applied in resolution of environmental conflict without regard to impact of those decisions on human needs and human goals and how they relate to our natural support system, the environment. A technological solution may very well be feasible and logically consistent, but the question is whether or not it should be applied in light of the consequences on society or the environment. How to best prioritize our needs and evaluate trade-offs lies within the realm of social moral/ethical reasoning.

This model responds to the need to stimulate upward progression. Research ~~XXXXXXXXXX~~ revealing development through Piaget's cognitive and Kohlberg's moral/ethical stages reveals that people do not advance at a consistent rate. More often than not, particularly at the upper levels, we find low rates of advancement, or fixation at a given stage. For example, research findings indicate that about 50% of late adolescents and adults are formal logical thinkers while only about 10% of the formal thinkers reason at Kohlberg's principled moral/ethical level. (Kohlberg, 1975). These findings further suggest that although reasoning in the moral/ethical realm is dependent on cognitive development, it does not necessarily develop along in a synchronous manner (Tomlinson-Keasey, *et al.*, 1974).

If indeed more people tend to reason at conventional levels, which is characterized by reasoning dictated by peer group interests or rigid adherence to rules without understanding their basic tenets, or at preconventional levels, which is characterized by "what is best for me is right" reasoning, then environmental problem solving may well be limited to localized self-interest solutions. Such limited perspective in decision making may create further problems and increase environmental conflict.

Curriculum Strategies

The application of our socio-scientific reasoning curriculum model which combines the ideas of Piaget and Kohlberg centers on identifying those learning experiences important in assisting students' advancement through the stages. In addition, this model will also help curriculum developers determine what kinds of activities are appropriate for different students at different grade levels with different needs. Implicit in the stage theory is that at each stage there is a unique form of thinking capability which determines how experiences and information are interpreted and acted upon. An example of those strategies and activities which we consider appropriate for secondary school students is found in the Appendix.

The strategy underlying all of these activities is that of creating disequilibrium. According to Piaget (Piaget, 1970), it is only when disequilibrium is created that active restructuring of thought processes takes place, leading to movement into the next higher stage. Restructuring occurs when internal disequilibrium is felt by the individual. That is, new experiences and input comprehensible to the individual challenge his/her existing mode of thought by revealing inadequacies or inconsistencies in that problem solving strategy. Arrest at a given stage is explained by the developmental theorist as the lack of opportunities that create conflict or dissonance, thereby placing the individual in a position where he/she needs to reassess his/her particular mode of thinking. As pointed out by Clive Beck (1972), perhaps the reason people do not develop morally is because

they have not had the opportunity to entertain alternatives, i.e., their horizons have not been extended.

It is important to let the experiences and activities are comprehensible to the student at his/her level of functioning. While persons can begin to understand ideas/concepts and reasons at the next adjacent higher level, those at levels beyond do not lose their meaning and relevancy, because the existing conceptual framework cannot deal with those higher levels of abstraction or complexity. While a young child can understand a statement such as, "We are running out of oil," he/she has no understanding of what this means in terms of life style impacts, equity in allocation of scarce resources, or economic and political ramifications.

We have identified the following as some of the basic elements needed to provide those experiential opportunities that would expose students to higher level reasoning:

1. Exposure to alternative viewpoints.
2. Taking the perspective of others.
3. Examining and clarifying one's own ideas.
4. Examination of consequences and implications of decisions.
5. Defending one's position.

An educational activity incorporating these elements is the classroom dilemma discussion, an activity employed by Kohlberg and his colleagues. We have, however, modified and extended this approach to include more critical analysis and evaluation of information and data, and we have adapted it in other formats such as role-playing, simulation games and futures forecasting.

Kohlberg's basic approach is to present a hypothetical, heightened moral dilemma to trigger discussion. Students choose a course of action that the main character should take, and they defend that position with supporting arguments and reasons. The focus is on dynamic student-to-student interaction with the idea that within a classroom there is a diversity of stage reasoning models. In discussion, students are thus exposed to divergences of viewpoint and differing levels of reasoning. Students taking different positions will question and challenge "why" a particular stance is held. In the course of discussion, students will reflect on their own thinking, clarify their arguments and evaluate the adequacy of other reasons. The emphasis is not on the desirability/value of one position over the other, but in the process of reasoning and how convincingly an argument is constructed. In a heterogeneous group, the students thus encounter higher level or +1 reasoning.

Kohlberg's typical dilemmas are set in an isolated context and involve conflict between two or more moral issues, i.e., the value of life and the necessity to obey the law or to respect authority. The classic example is one in which a husband faces the dilemma of deciding whether or not to steal a drug to save the life of his wife if he has no other way to obtain that drug. For our curriculum materials, we have set the dilemmas in an environmental context which adds another dimension to the dilemma, that which elicits scientific, logical reasoning in addition to moral/ethical reasoning. Our environmental dilemmas require thinking about scientific and technological issues, the conflicts at that level, and how those effects relate or impact on the social and natural environment, raising moral/ethical issues, i.e., socio-scientific reasoning. In this way we have integrated environmental issues at the scientific level and the social moral/ethical level, this we feel is a more inclusive and comprehensive approach for addressing environmental problems.

However, effective discussion cannot take place in a vacuum. Needed also is a knowledge base from which students can begin to gather, analyze and evaluate information. With information which they have extracted and synthesized, additional ideas and rational arguments can be developed for discussion. Again, we

have employed a variety of formats, ranging from readings, dramatic dialogue, role playing, charts and graphs, and student research activities to filmstrip-tape presentations. For the lower secondary school grades, information is presented in a more activity oriented format, while in the upper grades readings, frequently original articles, are the more common format. The data base also serves to bridge the gap between the real world and the heightened hypothetical dilemma situation. The dilemma, therefore, will not be construed by students simply as a story, but as a reflection of real environmental issues and ensuing conflicts at personal, community, national and international levels.

Rather than attempt to present the information/data in a purely objective manner, the feasibility of which we seriously question, we have instead elected to present it from several points of view, and to demonstrate how similar information is differentially interpreted. In this way, students can also begin to make critical judgments as well as gain wider insights on what appears as a limited technical question.

In several instances we have also used the dilemmas themselves to build up the information base. That is, implications from certain kinds of decisions are extended to produce other dilemmas, or another aspect of the problem is brought out in a subsequent dilemma. This allows in-depth exploration of an environmental issue/problem and consideration of several of the many impinging variables. Hence, the complexity in resolving environmental conflict becomes readily apparent.

Since interactive discussion in small student groups may not be the more common type of classroom activity, we have also included alternative positions and reasons (keyed to different reasoning levels), as well as a series of probe questions which may be used in a variety of ways to engage students in the discourse. Depending on the level of interest of the class, probe questions frequently lead to development of additional dilemmas by the students themselves.

Following dilemma discussion, several types of extension activities are suggested. These serve as a mechanism for students to put some of the ideas and judgments that have emanated from the discussion into a larger structural framework. They also provide students with an opportunity to project into the future, thinking beyond their own immediate experience and considering implication of different decisions on future society.

Curriculum Materials Based on the Socio-Scientific Reasoning Model

The curriculum materials produced by our Institute exemplify the flexibility and adaptability of the socio-scientific reasoning model in curriculum development efforts. Our materials are "free standing" modules that can be used in a number of different courses in a variety of ways. This circumvents the problems encountered in implementing new courses of study in the existing highly structured school programs. Moreover, it illustrates the transdisciplinary nature of environmental education in that its issues impinge on nearly every subject area of study. For example, our modules are currently being field tested in social studies, civics, world affairs, health, biology, chemistry and earth science courses. This also represents our belief that the concepts and concerns of the other subject areas should be extended to interface with the wider scope of environmental education, and that environmental education not be limited to a single course given at the secondary school level. In addition, our modules are designed for different grade levels, ranging from grades 7-12, so that exposure to environmental concerns may be a continuous and integral part of the existing school program.

The internal flexibility of each module allows teachers to conduct them as mini-courses, to intersperse activities throughout a given course of study or teach it as a discrete topic of study. Typically, each module can be conducted within a 4 to 6 week period. Several of the modules are designed so that they may be used in part or in their entirety.

At present, we have produced ten modules, and four additional modules are

planned for the coming year. Our modules for the senior high school include: Dilemmas in Bioethics, Beacon City, A Land Use Simulation, Environmental Dilemmas, Critical Decision for Society, and Perspectives on Transportation.

For the junior high school they are: Energy: Decisions for Today and Tomorrow, Future Scenarios in Communications, Decision Making in the Coastal Zone, Space Encounter, and Values in Conflict.

The modules range from those which are highly structured sequentially to those which contain discrete, independent activities. The modules for the lower grades tend to be more structured, with subsequent activities building upon skills learned in prior activities.

An example is Future Scenarios in Communications which examines the impact of two technological applications on society using several forecasting techniques. The students first develop forecasting skills using a known data base, their knowledge about the telephone; and in the second section, they again use the same techniques to make forecasts about computer impacts. Least structured are Dilemmas in Bioethics and Environmental Dilemmas which contain twelve separate dilemma discussion activities that may be used selectively in any order. Energy: Decisions for Today and Tomorrow presents three energy topics developed in self-contained sections which may be studied sequentially or selectively. Within each section the broad spectrum of problems and concerns associated with an energy source are examined in several contexts.

All the modules, however, are related by a common thread. That is, each provides meaningful experiences for students which stimulate a personal sense of conflict and expose them to a higher level of reasoning. As we have indicated, this process can be effected using a variety of educational techniques, provided that they are appropriate for the unique thought structures of different cognitive levels and present opportunities for students to reflect upon the adequacy of their own thinking.

Assessment of the Socio-scientific Reasoning Models

Preliminary results of our field tests have indicated that exposure to our curriculum material produces increases in knowledge, critical thinking skills (Cornell Critical Thinking Test) and moral/ethical reasoning (Defining Issues Test, Rest 1976, and Environmental Issues Test, Iozzi 1976).

Conclusion

The socio-scientific reasoning model which has guided our curriculum development efforts is, we believe, an effective and relevant model for environmental education. The developmental perspective offers several important dimensions in curriculum development. Addressing both the intellectual and moral/ethical realms of development, we can better prepare students for knowledgeable and wise environmental decision making. Understanding the ways students deal with information at their different thinking levels, we can then develop those instructional materials that will help advance their thinking.

We are confident that application of this model is most appropriate for promoting the goals of environmental education--creating an environmentally ethical citizenry that has a broadened conceptual view of the interdependent world in which we live.

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Developmental Models**Characteristics of Model Relevant To Secondary School Students**

PIAGET: Cognitive development in sequential, invariant stepwise stages. Change via restructuring of thought processes through assimilation and accommodation.

Transition from concrete to formal logical thought operations, proportionality operations, combinatorial operations, probability operations, logical propositional operations (implications, disjunction, compatibility, etc.)

Thinking in a hypothetico-deductive manner.

KOHLBERG: Moral/Ethical reasoning develops in sequential, invariant stages, advance to higher stages by resolution of disequilibrium caused by recognition of inadequacy of own reasoning.

Transition from conventional to principle level of reasoning. Decisions based on principles that have validity, consistency, and application apart from authority of groups and individuals, guided by self-chosen ethical principles and concerns for universal social justice and individual rights.

PROBLEM SOLVING, CRITICAL THINKING... as function of development in cognitive structures and moral/ethical reasoning abilities. Leading to increased sophistication in problem solving strategies.

Problem definition encompasses more extensive perimeters. Problem seen in holistic fashion-ability to isolate important elements. Search for relevant information. Entertain alternatives. Evaluate possible alternatives and validity of argument. Test alternatives. Evaluate solution and make revision.

APPENDIX**Curriculum Strategy- Provide Students Opportunities to:**

1. Reason hypothetically-deductively;
2. Generate possible alternatives;
3. Distinguish probable and possible events, dealing with reality and abstraction;
4. Consider consequence of alternative actions;
5. Interact directly with content of learning;
6. Integrate personal experience into greater social whole "decentration";
7. Isolate variables to test validity of proposition, controlling variables;
8. Relate ideas one to another;
9. Reflect on own thinking.

Curriculum Activities

1. Projection of future possibilities;
2. Role playing;
3. Simulations;
4. Individualized Research of Problems/Issues;
5. Case Studies from Wide range and variety of materials;
6. Active Experimentation/ Systematic Analysis;
7. Debates-Developing Logical Arguments.

1. Interact with peers at more advanced stages of reasoning;
2. Consider perspective of other persons;
3. Experience diversity of alternative ideas;
4. Consider basis of personal value system and judgment;
5. Evaluation of information, judgments, and opinions;
6. Recognize role of self and society.

1. Dilemma discussions;
2. Role Playing;
3. Communications in small and large groups;
4. Reading and evaluating opinions and judgment of others;
5. Making choices and supporting those choices;
6. Prioritizing preferences.

All of the Above Plus:

1. Explore problems from perspective of different disciplines;
2. Integrate ideas and concepts; understand appropriate relationships;
3. Generate hypotheses and test;
4. Consider short-range and long-range effects and implications;
5. Explore different problem solving strategies;
6. Apply appropriate methodology; recognize demands of problem;
7. Use different information sources.

COMMUNITY-BASED ENVIRONMENTAL EDUCATION IN WESTERN PENNSYLVANIA

Thea Teich¹, Woodward S. Bousquet², Lyn Fleming³,
Suzanne Klineman⁴, Denise Oiczak⁵.

Introduction

Environmental education is not kid stuff. We have all heard countless times the fact that the environmental decisions we make today will affect several successive generations. We have all seen the effects on our landscape caused by the decisions (or refusals to make decisions) of our grandparents. However, despite this obvious need to educate the voting public today, whenever environmental education is mentioned, people think immediately and only of the formal public school system.

Community-based environmental education aimed primarily at adult audiences is more difficult to establish than ongoing formal school system programs. One reason is the lack of a captive audience. Another is the diversity of community-based institutions that might sponsor environmental education. This diversity causes problems of standardization. What might work in Pittsburgh, for example, probably would not be successful in a rural community. A third concern in developing community-based environmental education is motivation. The program must either interest participants through enjoyment or entertainment values or be extremely relevant to their everyday lives. An informational meeting about land use in the abstract will attract far fewer participants than would a public session on the sewage treatment plant or energy-generating facility to be built just down the road.

Thus, community environmental education requires different sets of goals, objectives, and strategies from those used in formal education. The program developer cannot assume eagerness to learn. More often than not, the audience would rather avoid the topic entirely. On the other hand, once the audience is motivated by either enjoyment or the relevance of the topic, there is often a good chance that the developer can expect the signs of a successful program: behavior change and action.

Pennsylvania is a "keystone state," bridging the eastern seaboard and the Great Lakes States. Western Pennsylvania is part of a "tri-state" region, which includes West Virginia and eastern Ohio. Rivers and creeks are numerous, and the land is hilly and heavily mined for coal. Heavy industry is present and barge traffic predominates along the larger rivers. There are also many small, rural towns and magnificent state parks. The Western Pennsylvania Conservancy is one of the nation's most successful organizations in preserving biologically significant tracts of land.

An area of this size and diversity has a number of environmental problems. It also has a number of resources, both in public agencies and private organizations, to work on those problems. The Group for Recycling in Pennsylvania (GRIP) formed some of the first recycling centers in the United States. As a result of the efforts of GASP (Group Against Smog and Pollution), Allegheny County's air pollution ordinances are more stringent than those of the rest of the state. Many of the goals of GASP are now institutionalized as part of the program of the Allegheny County Department of Health.

However, as we are all aware, fewer resources are available to organizations today than there were in GASP's heyday. Because of this, and because of the growing complexity and pervasiveness of environmental problems, the need for environmental education at all age levels is omnipresent. This need has led to the development of several community-based environmental education programs in western Pennsylvania, funded and sponsored through a variety of resources.

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McKeever Environmental Learning Center

Located on a 200-acre tract adjacent to Goddard State Park, McKeever Environmental Learning Center is a publically funded "living textbook" and resident facility about 75 miles north of Pittsburgh. The site is within 50 miles of every land use category in Pennsylvania: forests, cities, towns, farms, parks, water, mines. Ivan McKeever, Pennsylvania's Soil Conservationist for 20 years until he retired in 1968, originated the idea, and in 1974, McKeever began operations under the auspices of a consortium of eight institutions: Clarion State College, Edinboro State College, Indiana University of Pennsylvania, California (PA) State College, Slippery Rock State College, the Pennsylvania Department of Education, the Pennsylvania Department of Environmental Resources, and the Sandy Creek Conservancy. Most of the funding comes from the Pennsylvania Department of Education, and the Clarion State College holds administrative responsibility for McKeever. McKeever's three lodges can accommodate 150 residents, plus there are auditorium, classroom, and dining facilities.

The McKeever Environmental Learning Center's approach to community education is to encourage people to take action to improve the environmental quality of their home communities. To this end, community investigation is a component of many resident programs. The "How to be an Earthkeeper" program, designed for middle school students, takes them from the abstractions of the "web of life" concept to the application of environmental principles to identifying and solving problems in their home communities.

Environmental workshops for adults also center around the improvement of home-community environments. McKeever staff utilize U.S. Forest Service environmental education materials, Investigating Your Environment. Participants "invade" the nearby town of Greenville, Pennsylvania, to do a community survey and learn techniques they can later use to determine the good points about their own communities and what items could be improved. Concerns include recreational resources, fire and police protection, schools, transportation, social activities, all the ingredients that go into what is called "quality of life".

Lakeview School District's Energy Stewardship Program (ESP)

Less than five miles from McKeever is the main office of the Lakeview School District, which in 1977 received federal funds through Title IV-C for the development of an energy program. The three-year grant is supervised by the Pennsylvania Department of Education, and the overall goal is to obtain state validation for the program which would make it available to all school districts in the state. Project ESP is a grassroots attempt to educate the Lakeview youth and adult community to the satisfactory adjustments in lifestyle, economics, education and government which responsible energy stewardship requires.

ESP takes advantage of the relevance of energy usage and its effects upon the homeowner's pocketbook in motivating people to take action and conserve energy. Workshops on home weatherization, energy conservation, alternative energy sources and solar energy have been well attended. A Winter Carnival encouraged participation in energy-conserving rather than energy-consuming winter sports. Thus, Winter Carnival participants favored sleigh rides to snowmobiles, cross-country skiing to chair lifts. When the snow melted, a community organization took over the leadership role in developing a bicycle path throughout the area, enabling this energy-conserving mode of transportation to be utilized safely. At the same time, new energy materials have been developed and already existing materials have been made available to teachers and students in the district.

Lakeview's "Energy Expo", May 20, 1978, was the day teachers, students, and community groups reported on progress made in energy conservation. This combined emphasis on social activity, education, and pocketbook realities has led to the resulting success of Project ESP.

Creative Recycling Center

Some 75 miles south in Pittsburgh, another community-based environmental education program has begun, behind a storefront in a middle-income residential and commercial area.

The Creative Recycling Center is a non-profit educational organization established to promote conservation through the creative re-use of industrial by-products and discards. Support has come from a variety of sources: HEW's Office of Environmental Education, Pittsburgh family foundations, and the Junior League of Pittsburgh. In-kind services have come from Center sponsors: Goodwill Industries and Allegheny County Environmental Coalition. The Center has also received funding for special projects from the Pennsylvania Arts Council, Western Pennsylvania Conservancy Playground Foundation, and the Pittsburgh Foundation. Income also is derived from the sale of waste, workshops, special events, memberships, and donations.

To achieve its goal of giving waste a value, the Creative Recycling Center collects and distributes industrial by-products, designs substantial items from the discards, and provides environmental information about the sources of raw materials used in manufacturing and the implications of our "throw away" society.

The process starts with a call to a local industry to find out whether they have potentially re-useable scrap. Despite their surprise at being asked this question, industrial leaders have usually been cooperative, once they learn that the materials will be used in programs for teachers, community centers, artists, rehabilitation centers, etc. Even more important, the industrialists have sometimes been stimulated to ask their own question, "Is anything we are throwing away potentially re-usable?" Some 350 contacts with local industry have been made this way since the Center opened in early 1977. The discards collected are sold for a nominal fee at the Center's store.

Most people learn about the Center because of the variety of items available in the store. They are usually very surprised to learn that the items would have found their way to a landfill had they not been collected by the Center. The point of origin of many of the by-products is also often a mystery. Some visitors do not know that cork comes from the bark of trees, or that many synthetic fibers are made from petroleum and coal tar. The Center's goal is to make people realize that paper and plastic, for example, are not scraps to throw away, but are parts of trees and barrels of oil and therefore, worthy of recycling and re-use.

Leonard S. Mudge Environmental Education Program

Just a few zip codes away from the Creative Recycling Center is Carnegie Institute which houses the Carnegie Museum of Natural History, the Museum of Art, Carnegie Music Hall, and the main branch of the Carnegie Library of Pittsburgh.

In early 1976, the Section of Education of Carnegie Museum of Natural History was awarded an ongoing gift in memory of a former museum trustee, Leonard S. Mudge. The gift was earmarked for an outreach environmental education program aimed mainly at adult audiences. The overall goal was to make museum resources available to organizations and agencies involved in environmental education through cooperative programs, projects, and services. The Mudge Program is aimed at providing information and education services that present the ramifications of an issue from a variety of viewpoints, so that the participants can make a decision and know that it is an intelligent one.

Projects included in the Mudge Environmental Education Program include:

Out of Doors Days, a series of workshops and field trips cosponsored with the Western Pennsylvania Conservancy.

Environmental Issues of the Pittsburgh Region, a conference series developed in cooperation with an advisory committee of representatives from Pittsburgh environmental organizations and agencies.

Interactions, a bimonthly newsletter.

People, Places, and Programs for Environmental Learning, an inventory of Pittsburgh region environmental education resources.

Field Photography, an adult education short course.

The Natural World: A Photo Contest, an annual field photography course.

Interpreters Forum, an informal organization of area non-formal environmental education personnel.

Environmental Education workshops for teachers.

Occasional special events, exhibits, and internships.

The Leonard S. Mudge Environmental Education Program is a leadership program, a coordinative program. It brings people and their ideas together with other people with other ideas. The resulting program may be different from the original thoughts, but the process does seem to work.

ENVIRONMENTAL EDUCATION IN THE CONSERVATION DISTRICT PROGRAM

Willard Morris¹

The purpose of this paper is to explain what conservation districts are doing in environmental education and to suggest ways in which colleges and universities can use conservation districts in environmental education.

First, however, let's take a look at what conservation districts are and review their organization -- because this is very relevant to what they do, their point of view, and how they can work most effectively with the educational organization. Conservation districts go by a variety of names depending upon the legislation which authorized them in each of the states. In Illinois, they are called soil and water conservation districts; in Iowa, soil conservation districts; in New Mexico, natural resource conservation districts; and in Pennsylvania, just plain conservation districts. They are the local units of government which are charged by the laws in each state to carry out programs to conserve the soil, water, and related natural resources.

I would like to emphasize that conservation districts are the only local entity of government which exists all across this country with responsibilities for the conservation of natural resources. At times, they are confused with the federal Soil Conservation Service, with the Extension Service, or (in the northeast) with municipal conservation or environmental commissions. This confusion is natural because their names are similar and because they often work together to achieve common objectives. The conservation districts I'm talking about, though, are generally county units and are made up of local citizens who are either elected or appointed to the district board. Just as with many other local government officials, they are unpaid.

The basic responsibility of conservation districts is to provide for the conservation of the natural resources within their area. They do this by identifying the conservation problems, establishing priorities, and serving as the coordinating center for all types of assistance for achieving solutions to these problems. Assistance is sought from government agencies and from private individuals and organizations. Conservation districts lean heavily on the technical expertise of the U.S. Soil Conservation Service, and state forestry and fish and game departments; on the financial assistance available from the U.S. Department of Agriculture's ACP program; and on information and educational assistance from the Extension Service.

Districts were first established more than 40 years ago, following the great dust bowl days. They have developed a wealth of experience and have amassed a great deal of information about the condition of the natural resources within the district and about remedial measures to deal with problem situations. They've also developed long-range preventative programs which have their base in information and education.

WHY CONSERVATION DISTRICTS ARE INVOLVED IN ENVIRONMENTAL EDUCATION

Conservation district officials know that the contour strip cropping which the farmer applies this year, or the developer's sediment basin or the landowner's tree planting, are conservation practices which are needed to deal with today's problems on that particular parcel. But what about 10 years from now? -- or a generation from now? Will there be informed citizens to make good decisions and to carry out appropriate conservation practices in the future? We know that we in the conservation district movement must deal with today's conservation problems, but we must also look to the future. That is why we are involved in environmental education.

Because conservation districts blanket the nation and include 97% of all the private lands in the country, it's natural that we have a lot of farmers on our boards. But we also have a lot of businessmen, teachers, and other citizens who are concerned for the conservation of their local natural resources. We clearly understand that it is not our function, for the most part, to do the teaching any more than it is our function to provide technical information to a farmer or to be a planning board. We see that our principal function in environmental education is to stimulate teachers to do a better job of including environmental factors in their courses and to help them to be better prepared to take their students into the out-of-doors for the real-world "hands-on" experiences which will mean so much to the students.

We believe that environmental education should be interdisciplinary in its approach, that it should emphasize active participation in preventing and solving environmental problems, and that it must be a continuous, life-long process, both in school and out. We also believe that the environment should be considered holistically— including its natural, political, economic, technological, social, and esthetic aspects.

EE Projects of Conservation Districts

Conservation districts carry out a wide variety of educational projects. Every conservation district personalizes its program, adapting it to the needs of that particular district. About half of the projects are associated with schools and the other half are fairly evenly divided between activities with youth organizations, publicity and promotional activities, and district-oriented EE projects. Let me just cite a few so that you can get an idea of the range of conservation district environmental education activities.

- Help schools establish outdoor classrooms.
- Provide teacher scholarships to EE workshops.
- Assist in establishing an EE advisory council in each school district.
- Arrange to discuss EE at teachers' meetings.
- Provide teachers with a list of community conservation activities which classes could undertake.
- Provide schools with EE curriculum guides or packets of EE information.
- Find land that can be used for school outdoor classrooms.
- Provide mini-grants to schools for EE projects.
- Conduct conservation tours for teachers and school administrators.
- Publish a conservation education newsletter for teachers and youth leaders.
- Work with the media to get public recognition of conservation education activities in the district.
- Sponsor high school or youth conservation clubs.
- Assist with scout conservation merit badge programs.
- Sponsor public forums on local conservation issues.
- Sponsor recognition programs for EE accomplishments.

And the list goes on and on.

Typically, a conservation district will have an education committee and will appoint either one of its Board members or an interested citizen as chairman. These committees will usually include one or more teachers, youth leaders, and media people.

EE Programs of State and National Association of Conservation Districts

The National Association of Conservation Districts and each of the state associations also have education committees made up of representatives of local conservation districts. Among the high priority activities of state associations are:

1. Formation (if needed) and activation of an environmental education advisory council, a group to advise the state education agency.
2. Employment of at least one full-time environmental education consultant or coordinator by the state education agency.
3. Formulation and implementation of a state environmental education master plan.
4. Pre-service preparation of teachers in environmental education as a part of their regular university education.
5. Adequate funding for environmental education on a regular basis through the state education agency.

State associations have zeroed in on these five objectives. Working with a broad representation of leaders in many fields who share these objectives, we have made significant gains over the past few years in many states. We most definitely are not a political body, but we do represent citizen interests in every state.

What Colleges and Conservation Districts Can do Together

District cooperation with colleges and universities in developing environmental education programs will probably center around three important areas of interest:

1. Environmental education programs that will prepare pre-service teachers for working on conservation projects with students in elementary and high schools.
2. Developing summer sessions, workshops, and other environmental education credit courses for in-service teachers to enable them to do a better job with programs and projects in elementary and high schools and to incorporate environmental studies into all curriculum areas.
3. Assisting with information and technical help to develop environmental education courses of general interest for non-science majors among undergraduates.

A secondary benefit of such programs lies in providing an opportunity for college faculty members in various disciplines to get together and work toward an environmental education curriculum that will incorporate both natural and social sciences to serve both undergraduate and graduate students.

Other services to colleges and universities include:

1. Establishing scholarships to encourage in-service teachers to enroll in credit courses in environmental education.
2. Assist in providing resource specialists who can serve as guest lecturers or instructors in fields relating to resource management and environmental education.
3. Help develop outdoor learning laboratories on campus for training pre-service teachers in the use of an outdoor classroom at elementary and high school levels.
4. Offer cooperative assistance in developing adult classes in environmental education that will be of interest to local governments, officials, conservationists, resource managers, and citizens interested in community improvement.

Working Together

I would like to conclude by emphasizing that conservation districts are action agencies of local government. They have a responsibility for the conservation of the soil, water, and related resources in their district. District officials realize that they must be involved in environmental education as a part of their action program if they are to achieve success in meeting their objectives over the long run. For the past four decades, conservation districts have shown remarkable achievements in carrying out voluntary programs to control erosion and sedimentation, in minimizing flood damage, in conserving wildlife, and in improving forest lands. They are carrying out effective programs for the rehabilitation of strip mines, planning for the conservation of resources in urbanizing lands, in assisting in outdoor recreation and the conservation of water supplies. Conservation districts are also carrying out a wide range of effective environmental education programs in cooperation with teachers, educational institutions, youth groups, adult leaders, and others.

While conservation districts have achieved a great deal in both action programs and in environmental education projects, there are many, many things left undone. It's clear that we need to work more closely with the colleges and universities in the future than we have in the past. Perhaps we've often been either too shy or a little afraid of the academic community because we are just "general practitioners." Our two groups each have a great deal to contribute to the overall objective of improving the level of environmental education in our school and communities, district-by-district and state-by-state.

ENVIRONMENTAL EDUCATION IN THE U.S. DEPARTMENT OF THE INTERIOR

Hope T. Moore¹

I am here today with a specific assignment -- to describe Interior Secretary Andrus's commitment to environmental education. But I would like to start at the top, and remind you of what President Carter said in his Environmental Message to the Congress last May. That message may very well survive, historically, as the first time a President of the United States specifically articulated the systems nature of our environmental dilemma, and prescribed a systems approach to solving its problems.

First, he acknowledged the "great variety" of programs that are necessary in order to deal with such things -- and he spelled them out -- as "preserving wilderness, wildlife, and national historic resources," and then he called for measures to "stem the torrent of pollution" -- to halt the environmental damage caused by our frantic search for more energy. He saw the need for new sources of energy to keep our human-built systems humming, but he also saw the threat to the natural systems on which this human-built superstructure is built and on which it consistently draws for all kinds of unpaid work.

In essence, these two stated considerations tie our two major crises together for the first time at the Presidential level, and recognize them as ONE!

The primary challenge to environmental understanding today is to find every possible way to say -- to as many people as we can reach -- the same thing the President was saying to the Congress. Energy and Environment are two sides of one increasingly slippery coin, and "coin" is an apt metaphor, since economics addresses both sides.

Secretary Andrus has taken the President's charge and rephrased it as it applies most specifically to Interior. "We will develop," he has said, "but we will develop within the constraints of preserving the environment!"

Again, the wisdom of systems is observed! You don't kill the goose that lays the golden eggs! The circular nature of the biosphere is recognized -- the claim of unborn generations to life and breath and sustenance -- none of which can be guaranteed much longer unless we bend our linear style of thinking and planning into something that resembles more nearly the real world we are working within.

"Pick a flower, move a star," the poet sang. John Muir put it differently: "You try to move one thing and you find it's hitched to everything else in the universe."

No matter how you say it, it adds up to systems, and the fact is that we are IN the system -- not outside it, pulling strings.

Assistant Secretary of the Interior Robert Herbst and his deputy, Dick Myshak, now Johnnies-come-lately to this view of the world, or the environmental education approach for tackling its problems. Myshak is President of the Conservation Education Association and was chairman of the committee that put together the Alliance for Environmental Education, a group that now, as you know, represents 34 powerful organizations, from professional teacher groups to such non-governmental organizations as the National Wildlife Federation and the Izaak Walton League.

At a recent meeting of the State of Ohio's newly formed chapter of the Alliance, Secretary Herbst told the group something of his own roots in the EE movement, how he joined forces with other concerned environmentalists back in 1968 to prepare the Environmental Education Act, which passed the Minnesota legislature in 1969 and became a model for many other States:

It also set me firmly on the road to greater understanding of man's relationship to Earth as a whole, he told the Alliance, and helped me define my life's commitment.

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On the basis of this kind of backing, I think it is fair to assume that Interior is in the Environmental Education movement in earnest. As I told a group of Fish and Wildlife interpreters in Tucson last month, "Don't expect this cup to pass from your lips. You have a dedicated bunch of leaders who are going to make sure this movement goes forward," and I reminded them that each and every one of them is an integral part of the movement.

Herbst's message to the Ohio meeting was, "it can be done!" He described the effort in Minnesota to "add a concept of management to the synthesis of existing sciences which we now consider as 'ecology,'" and this is the route he has asked his agencies to take. In parks and refuges, Carter, Andrus, Herbst all understand the need for systems management, based on the soundest scientific research and information available. They further expect that management be reflected in public exposure to the workings of management -- how we interface the human and natural systems for the greatest "free ride" with the least impact we can make.

This is the way we are going, and as we develop materials, programs, and activities in support of this kind of interpretation, it will be done from a systems point of view. "Where does this information fit into the environmental process, and how am I involved? What effect do my actions have on the overall system? How does the effect I have on the system affect me in return? Where are the networks through which these effects travel and what choices and points of intervention are there to make a difference?"

These are not just questions for visitors. These are questions for interpreters, for rangers, for maintenance personnel, for concessionaires, and especially for the so-called "managers" of our areas. The more we ask such questions, the more we realize that the systems manage us at least as much as we manage them.

As educators, you may find that this approach suggests some ways you can become involved, either from a general systems standpoint (providing overall frameworks for on-site interpretation), or from a specific application standpoint (adapting the specifics of a certain site to the general systems format).

We intend shortly to employ certain temporary hiring procedures (Schedule A appointments or WAE -- While Actually Employed) to bring to Washington some uniquely qualified university people for intensive input into our EE programs. We want to tie in to higher education at the national level and also at the regional level. We envisage regional conferences that will include representatives from business and industry, as well as park and refuge personnel and university people, with the idea of finding all the common ground that environmental education can help us identify and explore. The nature of our environmental/economic dilemma dictates an end to polarization and a beginning of synthesis.

An understanding of systems is a basic intellectual tool, and we welcome your critical attention to what we do. People need to understand that when we change the system, we also change our options. If we begin to think through the processes we set in motion, we can start trying to create new choices (rather than closing them off). Every act of manipulation administers a "twang" to the web of process, and more often than not, a reverse vibration comes back and catches us in unanticipated ways. The challenge to interpreters is to tie the original action to the delayed reaction, to help people stretch their minds beyond a single event and become aware of the chains of linked events that constitute process.

Presidents and Cabinet members and their deputies can speak with the tongues of Solomon, but unless their listeners have some inkling of process, their wisdom withers. It is the sense of process that we seek to kindle through environmental education, and process depends on connections.

If we can use our parks and refuges to establish the idea of linked actions, of impact and reaction, of process and the inevitable participation of people whether they will it or not, then these set-aside fragments of Earth will have served their highest purpose yet.

The incredible thing about the energy/environmental dilemma was its absolute predictability. Given what we KNOW about our world and the natural laws that underlie it, the moment of truth was always there in the future, coming closer with every tick of the biosphere clock.

And yet it caught us by surprise. Not only that, but an enormous number of us still don't buy the truth. The short-term "fix" psychology is still the prevailing posture. The only way we can continue to be so blind is by keeping a double set of books, one called ecology, which is the bookkeeping of the biosphere, and one called economy, which is the bookkeeping of human society.

Meanwhile, we have a President who can read the columns of figures in both sets of books, and who, stares into the future and tells us to hurry, there isn't much time left to act.

Another major message that grows from environmental awareness and serves the environmental mission the President has laid out is the need to conserve. In our former waste lies the best hope of finding the energy to create new ways of doing things to survive the transition to better resource management.

The truth is that we have reached the bottom of our natural pockets. The one resource we have left that we haven't exploited is our brains, our human ability to make connections, to see beyond the moment, to modify our actions and improve our chances for survival within the energy budget that is still available.

President Carter is moving America purposefully into the paths of conservation for survival's sake. Conservation can buy us a little more time, can choke off waste and stretch the resources we have left.

Environmental education must be undertaken everywhere, in schoolrooms and board rooms, on the grocery shelf and the Outer Continental Shelf, at the gas pump and the city dump. The connections must be made, the real world prices will be paid!

What you are being asked to do is to use the resources of your areas to help America put the two seemingly separate rooms of our one house in order, to open the doors between them and learn, as today's youngsters say, to "go with the flow."

The Interior Department is a natural to lead this field. Because of the Topsy-like nature of its growth, Interior affords an outstanding array of opportunities for making the EE connections.

But nowhere in this department, that has been described as "the dust bin of government", is there a greater challenge than in linking the management and interpretation of our great natural areas, the parks and refuges that run mostly on solar energy but which still must serve a heavy overlay of fossil-fuel propelled human visitors.

Secretary Herbst is determined to base all resource management on science, and he sees this management as the underpinning for a dynamic, integrated, interpretive program that contains no embarrassing gaps between what we are doing with our resources and what we are saying about them.

As management and interpretation begin to mesh more positively, perception of the natural ecosystems and their interface with the human-built systems can become our most potent EE message. When management and interpretation become a seamless whole, when people understand their place in the natural systems and their responsibility to make wise resource decisions, we will have achieved our objective.

The recent worldwide conference in Tbilisi came up with a definition of environmental education that Secretary Herbst has picked up as key, not just for its rounded description of the task in physical terms, but for its moral component. It states that environmental education, "properly understood, should constitute a comprehensive lifelong education, one responsive to changes in a rapidly changing world. It should prepare the individual (you...me...visitors...EVERYONE) for life through an understanding of the major problems of the contemporary world, and the provision of skills and attributes needed to play a productive role towards improving life and protecting the environment with due regard given to ethical values. By adopting a holistic approach, rooted in a broad interdisciplinary base, it recreates an overall perspective which acknowledges the fact that natural and man-made environments are profoundly interdependent. It helps reveal the enduring continuity which links the acts of today to the consequences of tomorrow."

I like the nod to ethics in that Tbilisi Declaration. I think it is a signal that we are ready as a species to balance our competitive way of coping with a cooperative mode. Both are needed for survival, but competition has had the best of it most of the time. In spite of that fact, there have been numerous points along the evolutionary way where cooperation has spelled the vital difference between continued survival and extinction. If we at Interior do our job well in the parks and refuges, we may help you educators open up a growing awareness of the need to cooperate for a better world.

The November 7th issue of Time magazine featured as its cover story "How Man Became Man." It speaks of the dim, misty gulf of time, some $3\frac{1}{2}$ million years ago, when "circumstances placed a premium on cooperation, strengthening the bond between members of the group and starting man on the road toward developing language."

Said Richard Leakey, "The hominoids that thrived best were those able to restrain their immediate impulses and manipulate the impulses of others into cooperative efforts. They were the vanguard of the human race."

Once again, the human species is being presented with a set of circumstances that places a premium on cooperation, paying off for strengthening the bond between members of the group, rewarding those who are able to restrain their immediate impulses.

People need all the help, all the reminders, all the examples, they can get, to turn them into the paths of cooperating and conserving. Nowhere is the Federal Government equipped to do better its part of this job than on the refuges and in the parks. WE ARE WHERE IT'S AT, where the pieces of environment have been organized by the natural systems in such appealing ways and where they are running with such demonstrable quality and efficiency.

The mechanics of implementation, for the Interior environmental education thrust, are centered in a new Division of Environmental Education situated under the Chief Scientist in the National Park Service.

The mission of this Division, which has been designated as the lead environmental education sector for the Department of the Interior, will be to provide services to the National Park Service master planning process and to NPS field personnel, and to coordinate the various EE efforts within all three bureaus under Secretaries Andrus and Herbst. We do not plan to re-invent the wheel; we don't need to view it as a new discipline. It just needs incorporation.

The Environmental Education Division Chief will be the main staff person for the three-bureau steering committee, of which I have been appointed Chairperson by Secretary Herbst. I am also Secretary Herbst's representative of the FICE Sub-committee for Environmental Education and Energy Action. The recent National Leadership Conference in Washington gave Sub-FICE some interesting assignments that may sharpen our focus and show us new ways to mesh our knowledge, opportunities and efforts.

By filling the position of Environmental Education Director at Interior, Secretary Herbst will be taking the first step in his commitment to environmental education that grows naturally out of the interpretation and the management of the two systems, parks and refuges.

This is a MUST, the mainspring of all we do, that we base our management and our maintenance on the best science available and that our environmental education activities not be at odds with our management and our maintenance practices. There is no better way to teach EE than to demonstrate through our own actions the "better fit of man and nature" that spells quality of life.

One next-to-final thought: The President has told us to do just what the environment is also telling us to do. The beauty of having both science and politics on the same track is that everything you do toward environmentally sound management and interpretation is also a positive response to the President and to the goals of this administration. In effect, it is no longer politics, but policy.

I want to quote from the 1973 North American Wildlife Policy Report which seems to express the ultimate goal of environmental education. It was written by Dr. Durward Allen's committee, charged with up-dating the 1939 Aldo Leopold Game Policy Report, and it was inserted by Dr. Allen's committee as an appropriate culmination of the report, statement of hope and belief in the future. The Committee wrote:

Mankind emerged from the natural order; we must continue to live as part of it. We have but one earth, our home, our keep, our borrowed estate. We must accept the charge, at whatever cost, to maintain its abundance and guard its quality.

We seek understanding of other living things as the way to an enlightened husbandry of man himself.

We see a future that threatens the idle, the ignorant, the improvident. But we also see, in times ahead, the promise of a good life, if men with wisdom and humility will work for it.

I would like to make that "men and women," and express my confidence that together we can measure up to the task. It is not a small one, but few others are more heavily freighted with implications for the future of mankind.

GUIDELINES FOR AUTHORS

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GUIDELINES FOR AUTHORS

Manuscripts to be considered for publication in Current Issues in Environmental Education must be accepted for presentation at the annual conference of the National Association for Environmental Education. Such acceptance is a function of the Program Committee for the Conference.

Selection of manuscripts for Current Issues will be based on the basis of: 1) scholarship, 2) originality, 3) documentation, and 4) adjudged interest to the membership of the Association.

Manuscript Preparation

1. Manuscripts must not exceed 3500 words in length. They must be submitted in duplicate, typed, double-spaced, with standard margins, approximately 250 words per page. No single-spaced, bulletin typewriter type, or all capitals will be accepted.
2. Figures (drawings and graphs) must be sequentially numbered (Arabic) and must be cited in the text. Provide camera-ready copy in black (preferably India) ink, on heavy white paper or blue-lined coordinate paper, on separate sheets. Place labels parallel to the axes, using initial capital and lower case letters. Plan your figures for the smallest possible printed size consistent with clarity. Care should be taken to make lettering large enough to be readable after reduction to the 5 x 7 inch print format of Current Issues.
3. Tables must be sequentially numbered (Arabic), titled and cited in the text.
4. No photographs can be printed.
5. The title of the manuscript should be typed on separate sheet (page 1), with the names of the authors, their affiliations, and complete mailing addresses. Do not use abbreviations. The title may be a conventional one (composed primarily of nouns and adjectives), a sentence (containing a verb), or a structure with a colon.
6. Provide an abstract of 45 to 55 words on page 2. The abstract should amplify the title, but should not repeat it or phrases in it.
7. Begin the text on page 3. Place the name of the senior author and the page number in the upper right corner of each page of the text.
8. Insert subheads at appropriate places in the text to mark your main ideas. The set of subheads should show that your ideas are presented in a logical order. Keep subheads short.
9. Provide a summary at the end.
10. All references, sequentially numbered, should be placed at the end of the text. Use superscripts at appropriate locations within the text. Do not abbreviate journal names. Underline book and journal titles. Use a standard style for reference citations.

Deadline for Submission

Manuscripts must be received by the editors not later than 30 days prior to the annual conference. Send to: Dr. Craig B. Davis, 141 Bessey Hall, Iowa State University, Ames, IA 50011.

If you wish confirmation that your manuscript has been received, please enclose a self-addressed stamped postcard.

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A number of other publications sponsored by, or associated with, National Association of Environmental Education are now out of print, but may be located in ERIC microfiche collections or ordered from EDRS. Included are:

- ED 056 930 Man and Environment, Revised Curriculum, 103 pages, November 1970.
- ED 056 931 Man and Environment, A Bibliography, 113 pages, 1970.
- ED 071 855 Man and Environment, A Study Guide, Volume One, 106 pages, 1972.
- ED 071 856 Alternatives for Man and Environment, Revised Curriculum, 186 pages, 1972.
- ED 086 473 Man and Environment for Secondary Schools: A Curriculum in Environmental Studies for High Schools, 96 pages, November 1972.
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